No. 1506, dated Sabour, the 28th July 1916.

From—C. SOMERS TAYLOR, Esq., B.A., Principal of the College of Agriculture, Sabour, North Bhagalpur,

To—The Director of Agriculture, Bihar and Orissa

I HAVE the honour to submit herewith the Annual Report of the Sabour Agricultural College for the year ending 30th June 1916.

1. *Charge and Tours.*—I held the appointment of the Principal of the College throughout the year in addition to my own duties as Agricultural Chemist. I was on tour for 49 days during the year.

2. *Staff.*—The staff under the Principal remained the same as in the previous year.

3. *Education.*—On the basis of the resolution passed by the Board of Agriculture in India at Coimbatore in December 1913, a preliminary two years' course has been substituted for the three years' course, with the approval of Government, from the session 1916-17. This course is at present running alongside the old three years' Diploma Course. This latter will come to an end in March 1918. There is at present no provision for the further two years' course mentioned in the above named resolution.

The new course consists in the main of practical agriculture covering the main crops of the Province with a series of lectures on (*a*) cultivation and preparation of crops for the market, (*b*) live-stock and dairying, (*c*) rural economy, (*d*) simple mensuration. In addition to this lectures are given on elementary Botany, Chemistry, Entomology, Veterinary science, Physics and Mathematics sufficient to enable the students to grasp the main facts of agricultural practice. The field covered in agriculture will be practically the same as that in the old Diploma Course while the lectures in the allied sciences will merely give sufficient details to enable the student to understand his agricultural lectures. At the end of the two years' course an examination will be held and a certificate of efficiency will be awarded to successful candidates.

During the year, the first and second year students were only out on tour for a week to Pusa and Sepaya. This excursion was, I believe, of great benefit to them.

Examination.—The Diploma and Annual Examinations of the College were held from 23rd to 30th March 1916. As usual, the Diploma examination was conducted by the College staff with the assistance of external examiners. The following gentlemen acted as external examiners on the subjects noted against their names:—

MR. R. G. ALLAN, *Principal, Agricultural College, Nagpur.*	*Agriculture*
MR. G. CLARKE, *Agricultural Chemist, U. P., Cawnpore.*	*Chemistry.*
MR. R. J. D. GRAHAM, *Economic Botanist, Nagpur.*	*Botany.*
MR. D. QUINLAN, *Superintendent, Civil Veterinary Department, Bihar and Orissa.*	*Veterinary.*

Both the students who sat for the examination received the Diploma.

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In the 2nd year class four students sat for the annual examination and all were promoted to the 3rd year class.

Of the 13 students in the 1st year class at the end of the last session, only 10 sat for the Annual examination and nine were promoted to the 2nd year class.

Only one prize was awarded this year. This was given to Krishna Chandra Pal for Agriculture and Surveying. None other of the students deserved a prize.

Admission to Diploma Course.—Of the 14 students admitted to the 1st year class in June 1915, one did not join. Another student was however granted a scholarship by the Board of Trustees of the Sir Andrew Fraser Memorial Fund, Bankipur, and was admitted to the 1st year class with special permission at the end of July 1915. The number of admissions to the 1st year class in session 1915-16 therefore practically remained the same as reported last year. Of the total number of 20 students on the roll in the beginning of the session 1915-16, viz., six students in the 2nd and 3rd year classes, and 14 newly admitted, two obtained the Diploma, one left the College in the middle of the session, three joined the Bengal Ambulance Corps, and one having failed in the annual examination was not permitted to join when the College reopened for the new session in June 1916, after the long vacation. At the beginning of the session 1916-17, there were therefore 13 students in residence and 24 new students were admitted, of whom two left within a fortnight, The increase in the number of applications for admission this year is partially due to the fact that two years' course is more in favour than the old one of three years. The total number of students on the roll on the 30th June 1916 was therefore 35 as detailed below:—

3rd year class	...	...	...	4
2nd „ „	...	...	...	9
1st „ „	...	...	...	22

The statement below shows the distribution of these students by Provinces:—

Bihar and Orissa	...	...	...	7
Bengal ...	...	...	...	20
Assam ...	...	...	...	8

Four students from Bihar and Orissa and six from Assam receive scholarships from Government.

Short Course.—There were three students in the *Bhadoi* short course class which was held from June to September 1915 and four students were admitted into the *Rabi* Short Course class which opened in October 1915 and ended in January 1916. Of the *Rabi* Short Course Class students, one left after a few days' stay.

Scholarships.—With the consent of the Trustees to the Donor, the Harimohan Pranmohan Scholarship of Rs. 50 per annum was awarded to Brojo Gopal Das, a student of the 2nd year class. The Maling Grant Scholarship was held by Richard Buckley, who passed out of the College on obtaining the Diploma in March 1916. His place could not be taken by any students from the St. Andrew's Colonial Homes, Kalimpong, as Dr. J. A. Graham reported that he had no one to send for the present. At the beginning of the session 1915-16, five scholarships (including that sanctioned in 1913) were awarded at the instance of the Assam Government but one scholarship awarded to Nirode Behari Sarma was withdrawn from 1st April 1916 on account of his unsatisfactory work in the annual examination. Two more scholarships were

sanctioned in June 1916. The total number of scholarship-holders from Assam in June 1916 was therefore six as named below :—

1. Devi Prasad Gohain.
2. Kamini Kumar De.
3. Mohi Chandra Gogoi.
4. Lovel Lewis Reade.
5. Mohsin Ali.
6. Profulla Chandra Dutta.

Under Government order No. 7882R-1A-107, dated the 25th November 1915, three scholarships a year of Rs. 20 each per mensem were sanctioned by the Government of Bihar and Orissa for selected students belonging to Bihar, Orissa and Chota Nagpur on the condition that they will accept service with the Local Government, if offered, after passing the final examination.

These scholarships were awarded to—

1. Jayakrishna Pattanaik.
2. Kulamoni Pattanaik.
3. Monohar Jha.

Numbers 1 and 2 are residents of Orissa and No. 3 comes from Tirhut.

A special scholarship of Rs. 20 a month was also sanctioned by the Government of Bihar and Orissa in Government order No. 477R-1A-16, dated the 1st February 1916 and was granted to Banchanidhi Routraya, Overseer in the Angul Farm, to be held by him for two years while being trained for the post of a District Inspector.

A scholarship of Rs. 30 a month was offered by the Trustees of the Sir Andrew Fraser Memorial Fund, Bankipur, to one Mohiuddin Ahmad who joined the College in July 1915 but left on 23rd September 1915. Two scholarships of Rs. 25 each a month were awarded from this fund to Muhammad Mahmud and Jamuna Karji who joined the College on 15th June 1916; the latter scholar however left on the 29th June 1916.

Two scholarships of Rs. 15 each per mensem awarded by the District Boards of Maldah and Mymensingh are held by Brojogopal Das and Himadri Kumar Chandra Gupta respectively.

4. *Hostel.*—Babu Manmatha Nath Ghosh, Assistant Professor of Chemistry, was in charge of the Hostel throughout the year and as usual fulfilled his duties to my complete satisfaction.

The discipline of the students continued to be good ; a satisfactory record considering that students of different habits came from different parts of Bengal, Bihar and Orissa, and Assam.

At the request of the Registrar, Co-operative Societies, who had arranged a course of lectures at Sabour for the Managers and employees of Co-operative Banks, 16 persons were admitted in the hostel for three weeks.

The receipts from students show some improvement over the figure for the last year. This was on account of the increase in the number of students. Rupees 1,187-8-0 was collected as tuition fees as against Rs. 775 collected last year.

A fairly satisfactory amount (Rs. 508) was realized as rent and attendance at the rate of Rs. 2 per mensem. This was sufficient to cover the expenses of the temporary staff and leave a margin for rent. The expenditure on the Hostel establishment is given below —

	Rs.	a.	p.
Temporary Staff (cook and servants)	441	3	9
Permanent (durwan, chrukidar and peon)	228	0	0
Steward	300	0	0
	969	3	9

Under the head "Dietary charges" Rs. 1,927-3-0 was realized from the students and the expenditure for diet amounted to Rs. 1,861-3-9. In addition to this Rs. 105-3-6 was spent for purchase and repair of furniture and utensils and Rs. 72-9-3 for miscellaneous expenses.

Recreations.—The number of students during the majority of the period under review was small and it was difficult to get up a healthy interest in the games or to form a strong team. With the arrival of a large number of students during the present year there are many more possibilities of healthy recreation for the students. Foot-ball and hockey continued to be compulsory games in addition to which cricket, tennis and badminton were also played. The students played two friendly tennis matches with the Tej Narayan Jubilee College students of Bhagalpur.

The balance sheet of the athletic club is given below :—

Receipts.

	Rs.	a.	p.
By balance on June 1st, 1915	11	0	10
By subscription	170	10	0
Government aid	141	15	9
Interest	1	0	0
	324	10	7

Expenditure.

	Rs.	a.	p.
Cost of apparatus	125	2	0
Pay of servant	52	0	0
Expenses for playing matches	32	14	3
Miscellaneous	4	12	9
Balance in hand	109	13	7
	324	10	7

The Hostel Library has no record worth mentioning this year. No new books were purchased. The *Statesman*, the *Collegian* and the *Prabasi*—a Bengali Monthly magazine—continued to be taken. This absorbed the major portion of the fund.

A balance sheet is given below :—

Receipts.

	Rs.	a.	p.
Opening balance	6	15	3
Subscription from students	56	3	0
By Interest	0	5	4
	63	7	7

Expenditure.

	Rs.	a.	p.
Subscriptions to papers.	42	5	0
Miscellaneous	5	0	0
Balance in hand	15	2	7
	63	7	7

6. *Employment of Students.*—Two students were successful in the Diploma examination held in March last. One of them is being trained for the post of District Inspector. He has been appointed temporarily as a Supernumerary Agriculturist and deputed to the Sabour Farm for training. The other, it is understood, has enlisted.

7. *Public Works Department Construction.*—The construction of new quarters for Demonstrators and clerks, to accommodate 14 officers, which were taken in hand in the previous year, were completed during the year under report at a total cost of Rs. 36,508. The work on the Insectory was finished as well as that on roads and drains and laying out of pipe lines for water-supply to the clerks' quarters and Hospital. An outlet drain for the "A" Type quarters was constructed at a cost of Rs. 453. A scheme for construction of a sluice gate and certain miscellaneous works in the northern section of the Sabour Estate was sanctioned at a cost of Rs 1,217. The work has been completed, but the estimate has been revised by the Superintending Engineer, Eastern Circle, to Rs. 1,532 which is mainly due to the high rate charged for the screw gear, on account of war conditions.

The plan and estimate amounting to Rs. 19,563 for the improvements of the College grounds and hostel of the Sabour Agricultural College were sanctioned. Administrative approval to this project was accorded in Government order No. 7774R.-III-B—203, dated 16th October 1914. Sanction was also accorded to the plan and estimate amounting to Rs. 9,300 for the construction of a Guest House with out-houses, administrative approval to which was accorded in Government order No. 8844-R.-IIIB—19 , dated the 2nd December 1915. These two projects have been kept in abeyance for want of funds.

8. *Estate Work.*—As in the previous year, the College grounds were looked after by the Economic Botanist on behalf of the Principal. The usual temporary establishment of *malis* and sweepers was retained. Only the routine duties of clearing weeds and removing débris were carried on. Hollow places were filled up with earth and levelled with the roller. The foot-ball and hockey grounds were kept in proper condition. The planting up of the College compounds was almost completed, but much damage was done to the young plants by rats and white ants. The cost of the upkeep of the grounds during the period under report amounted to Rs. 2,716.

9. *Medical and conservancy.*—Sub-Assistant Surgeon Syed Moinuddin was in charge of the Dispensary and conservancy work throughout the year. During the year 5,469 cases were treated as compared with 2,601 in the previous year, the daily average attendance being 39 against 17·26 in the preceding year. This increase is due to the free dispensing of medicines, to the outside public, for which the District Board of Bhagalpur granted an annual subsidy of Rs. 250. It appears that the dispensary is gaining popularity.

The following statement shows the expenditure incurred on account of pay and allowance of the medical establishment and allowance paid to the Civil Surgeon during the year :—

——	Pay.	Allowance.	Total.
1	2	3	4
	Rs.	Rs.	Rs.
Sub-Assistant Surgeon	540	180	720
Compounder	180	...	180
Two peons at Rs. 8 each	192	...	192
Civil Surgeon	...	300	300
Total ...	912	480	1,392

The expenditure on medical stores amounted to Rs. 484.

The health of the students was good ; showing an average of ·66 absentee per day through sickness or injury. No infectious disease was reported nor was there any birth or death in the estate during the period under report.

10. *Library.*—The Library can now be said to be in working order, but there is still room for further improvement. Missing and back numbers of books have been purchased as far as obtainable and efforts are being made to procure the remaining ones. The manuscript of the catalogue of books and publications received in the Library up to August 1914 was made ready for the press, but, as it was anticipated that the cost of printing would be very heavy, the matter has been kept in abeyance for the present. This will however be done as soon as finances allow. Card Index record of all books, etc., received after August and up-to-date which have not been entered in the catalogue, has been prepared and it is proposed to revise the catalogue accordingly, when it is sent to the press. A check list of the Library books has been prepared and a similar list for the periodicals is in the course of preparation. During the year, 97 books were added to the Library by purchase, together with a collection of 54 books sent by the Director of Agriculture, Bihar and Orissa and 16 books presented by authors, etc. The Library has continued to receive periodically from different countries a large number of Agricultural publications in exchange for the Departmental Half-Yearly Journal. A total sum of Rs. 1,762-10-1 was spent for the purchase of books and periodicals out of the allotment sanctioned for the purpose. Back numbers of periodicals worth Rs. 1,581-10 were purchased from the Provincial Agricultural Association funds at the disposal of the Director of Agriculture and a further supply of publications to the value of Rs. 713-3, payable from this fund, is expected shortly.

11. *Office.*—All the clerks in the office have worked satisfactorily. I wish however especially to express my satisfaction with the work of the Head Clerk, Babu Surendra Nath Bhattacharjee, who has shown a very efficient grasp of all work connected with the office. The Accountant, Maulavi Golam Hossain, has also shown zeal.

The amount spent on contingencies under each of the detailed heads is given below :—

	Rs.	a.	p.
Freight on European Stores	186	8	0
Purchase and repair of furniture	195	4	0
Hot weather charges	113	3	0
Service Postage and Telegrams	319	14	0
Miscellaneous	1,439	4	6
Conservancy	66	1	6
Honorarium and carriage hire to Veterinary Assistant	386	0	0
Aid to Athletic Club	141	15	9
Books and periodicals	1,762	10	1
Up-keep of College grounds	2,716	5	3
Hospital expenses	483	14	3
Conservancy Establishment	630	15	6
Cost of European Stores	3,423	15	0
Student's Tour	115	5	6
Total ...	11,981	4	4

HOSTEL.

Dietary Charges	1,861	3	9
Furniture and Utensils	105	3	6
Pay of Menials	441	3	9
Miscellaneous	72	9	3
Total ...	2,480	4	3

During the period under review, 2,560 letters were received and 2,360 issued as compared with 2,381 and 2,316 respectively in the previous year.

12. *Publications.*—Volume III, Nos. 1 and 2 of the Departmental Half-Yearly Journal, was published during the year.

A statement showing the distribution of the journal is given below :—

	Rs.
Subscribers	348
Free List (Indian)	426
„ (Foreign)	29
Exchange (Foreign)	130
„ (Indian)	7

13. *Visitors.*—His Honour the Lieutenant-Governor of Bihar and Orissa paid an informal visit to the College on 14th February 1916. The Inspector-General of Civil Hospitals, Bihar and Orissa, inspected the College Hospital on 14th March 1916 and the Director of Agriculture, Bihar and Orissa, inspected the College twice during the year. The members of the Patna College Chanakya Society, accompanied by Mr. E. A. Horne, Professor of Political Economy, visited this College in August 1915.

I have the honour to be,

SIR,

Your most obedient Servant

C. SOMERS TAYLOR,

Principal.

No. 349, dated Sabour, the 28th July 1916.

From—C. SOMERS TAYLOR, Esq., B.A., Agricultural Chemist to the Government of Bihar and Orissa,

To—The Director of Agriculture, Bihar and Orissa.

I have the honour to submit herewith my annual report for the year ending 30th June 1916.

Annual Report of the Agricultural Chemist, Bihar and Orissa, for the year ending 30th June 1916.

I was in charge of the chemical section throughout the year.

Staff.—Babu Indubhushan Chatarjee left on being appointed as 2nd Laboratory Assistant under the Agricultural Chemist, Bengal, on 2nd July 1915. Babu Shashanka Bhushan oy was appointed in his place. Mr. G. Srinivasan, Assistant Agricultural Chemist, was allowed privilege leave for one month and 29 days and Babu Shashanka Bhushan Roy acted for him.

Teaching.—The teaching of all the classes continued on the usual lines during the Session, 1915-16. Mr. Clarke, Agricultural Chemist, Cawnpore, was appointed the examiner in Chemistry this year in the Diploma examination and appeared to be satisfied with the papers produced by the students. This year a two years' course has been started.

Sugarcane.—I have continued work on the substances other than sugar in the sugarcane and have definitely isolated aconitic acid from the juice in which it appears to exist in small quantities as the potassium salt. This acid was said to have been discovered by Behr in 1877 but Geerligs says that its presence requires to be substantiated. I have definitely isolated the acid from the juice of healthy canes and proved its composition by its analysis and melting point as well as by qualitative tests. I have also discovered a new colour reaction of aconitic acid to which I can find no reference in any publication and which I am now endeavouring to investigate. Aconitic acid and its salts are of considerable interests to the sugar manufacturer on account of the peculiar behaviour of its calcium salt in the evaporators.

Many fibre determinations and analyses of cane juice for the sugars were also made. The juice of the canes at Sepaya was analysed by my Assistant, Mr. Srinivasan.

Milk—Numerous analyses of milk were made. These were in connection with certain feeding experiments with rice meal which are now being carried out by the Professor of Agriculture.

Analysis of jowar *.—In continuation of experiments carried out last year with reference to the poisonous effects of *jowar* a plot of land was laid out on the farm for experiment with *jowar* planted late and early and also to determine the effect of water-logging. The work has been started but is not yet finished. An article 'Cattle poisoning by *jowar* and its prevention' was published in the Agricultural Journal of this Department during the year.

Permanent Experiment plots and Manurial Experiments on the Farm.—A number of analyses of crops from the different plots have been done during the year and the analysis of the soils for plant food contents was almost completed. The manurial experiments with wheat showed results only from nitrogenous manures. This would be expected as the supplies of potash and phosphates are ample in the Sabour soil.

Ground nuts.—A number of samples of ground nuts sent by Mr. Dobbs were tested to see if there were any correlation between their specific gravity and oil content. Preliminary experiments indicated that this might be a useful way of selecting high grade nuts, but more detailed investigation did not indicate a correlation of the abovementioned nature.

* *Andropogon sorghum.*

Miscellaneous.—A good number of feeding stuffs, manures, etc., were received and analysed in the laboratory and a sticky liquid was also devised for the Entomological section for use on the Andrés Maire traps.

Tours.—I was on tour for 49 days during the year. The most interesting tours were to Calcutta and Dhalbhum in connection with an enquiry concerning bonemeal and other chemical manures including apatite. A report has already been submitted on this subject. The owner of the apatite has expressed his willingness to supply it ready ground for experiments if we will pay the expenses of quarrying and grinding.

Merits of subordinate officers.—As usual, Babu Manmatha Nath Ghosh, the Assistant Professor in Chemistry and Physics, has been of very great assistance in all the teaching work and has shown also ability in experimental work. Mr. G. Srinivasan, the Assistant Agricultural Chemist, is a conscientious and accurate worker. Babu Shashanka Bhushan Roy, the Demonstrator, a former student of this College, promises well.

C. SOMERS TAYLOR,

Agricultural Chemist,

Bihar and Orissa.

No. 492-B., dated Sabour, the 26th July 1916.

From—The Economic Botanist to the Government of Bihar and Orissa, Sabour, E. I. R. (Loop),

To—The Director of Agriculture, Bihar and Orissa, Ranchi Secretariat Post Office.

With reference to your letter No. 5255-IR-24 of 16, dated the 4th July 1916, I have the honour to submit herewith a brief report on the Entomological work done by me and my Assistants during the year ending 30th June 1916.

Annual Report of work done in the Entomological Section during the year ending 30th June 1916.

I.—Administration.

Charge.—During the year under report, I remained in charge of the Entomological section, in the absence of Mr. E. J. Woodhouse, on military duty.

Staff.—The post of Demonstrator in Entomology was held by Babu Dhirendra Nath Pal, who continued to work satisfactorily. Babu Satya Ranjan Gupta, Fieldman in Entomology, accepted the post of Entomological Assistant in the Department of Land Records and Agriculture, Assam, and left this Department on the 3rd August 1915. Babu Jnanendra Nath Mukharji, a passed student of the Sabour Agricultural College, was appointed to the post of Fieldman in Entomology on the 1st October, 1915. The post of Entomological setter was held by Babu Biseswar Sahai.

Leave.—Privilege leave was enjoyed by Babu Biseswar Sahai from 17th January, 1916, to 16th February 1916.

II.—Scientific and Research.

With a view to finding out the æstivating condition of Agrotis ypsilon during the summer months, the Fieldman in Entomology was deputed to Ghogha where he worked under my instruction from the 13th March, 1916, onwards. The work was conducted on various lines and thorough searches were made in all possible quarters in the affected areas, but no trace of the insect in any one of its stages was found. The observation traps ceased to attract the parent moths from 8th April.

Various experiments, on the habits of Agrotis, were conducted by me in the Insectory at Sabour and some interesting results were obtained. The insect was successfully reared under Insectory conditions from December, 1915, to May, 1916, when on account of excessive heat and extreme dryness the whole brood died in spite of all steps taken to artificially maintain comparatively cool and humid conditions in the Insectory. From the field observations at Ghogha and Insectory experiments it may be concluded that the insect leaves the plains for some cooler regions, during the hot and dry summer months.

Life histories of some minor insect pests were worked out in part in the Insectory.

An Insectory was built during the year by the Public Works Department at a cost of Rs. 2,859.

III. Crop Pests.

(a) *Major Campaigns.*

Agrotis ypsilon.—The campaign against Agrotis at Mokameh was discontinued as the zamindars of the affected area were unwilling to bear the working expenses, which had so far been met by the Government. The Agrotis campaign at Ghogha and Colgong was continued with 56 improved traps which destroyed 437,956 parent months of which 212,355 were females. The total number of caterpillars destroyed during the season was 133,443. The result of the campaign was very satisfactory as the total damage amounted to 75 acres

only. The cost of the campaign including establishment and contingencies was Rs. 1,273-3-3. Mr. Maling Grant's Concern at Pirpainty contributed Rs. 182-1 towards the cost of the campaign for the work done in his area at Ekchari.

As some traps were found defective during the campaign, the improved slits were changed and replaced by more substantial ones at a cost of Rs. 347-3-9.

(*b*) *Other pests.*

Paddy:—*Hispa aenescens, Baly.*—A report was received from Balasore of Rice Hispa damaging paddy. A copy of the leaflet on the pest was forwarded for taking necessary remedial action.

Spodoptera mauritia, Boisa.—Rice swarming caterpillar was reported from Singhbhum damaging paddy. A copy of the leaflet with coloured plate wass forwarded.

Nymphula depunctalis, Guen.—Rice case worm appeared on several plots of paddy at Sabour Farm. Kerosine treatment and temporarily letting out water from the fields effectively checked the pest.

Ripersia sacchari, Gr.—Rice mealy bug on paddy was reported from Jagatsinghpur, Cuttack. Life history of the pest was explained and preventive and remedial methods recommended.

Juar (*andropogon sorghum*)—*Stenachroia elongella, Hmpsn.*—The *Juar* crop in the Sabour farm was slightly affected with Sorghum web caterpillar. It was recommended to plant the open-headed varieties, which are less susceptible to the attack.

Pulses:—*Agrotis ypsilon, Rott.*—Greasy surface caterpillar on gram was reported from Muzaffarpur. Picking off the first brood was recommended.

Diacrisa obliqua, Wlk.—From Madhipura, Bihar Hairy caterpillar was reported on *Kulthi* and *Kelai*. As the crop was being harvested no action was taken.

Plusia orichalcea, Fab.—Plusia on *rabi* pulses was reported from Farka and Inglis, Bhagalpur. The area was visited and the rope and kerosine treatment demonstrated.

Agromyza.—Pea stem fly appeared on experimental peas in the Botanical Experimental Area, Sabour. Affected plants were destroyed to check further spread.

Jute:—*Cosmophila sabulifera, Guen.*—Jute semilooper appeared on Serajgunj jute on the Sabour farm. It was completely checked by treating with rope and kerosine.

Diacrisia obliqua, Wlk.—A large brood of Bihar Hairy caterpillar appeared on Serajgunj jute in the Sabour farm. As it was in cluster stage it was completey picked off and the crop saved.

Sugarcane:—*Hieroglypus furcifer, Serv.*—Rice Grasshoper damaging sugarcane and *bhadoi* crops was reported from Siwan. It was recommended to plough up the affected area in the following April and May and to bag the nymphs as soon as they appeared during the rains. The areas were visited and the life history of the pest explained to the cultivators. Two insect bags were sent to the Subdivisional Officer, Siwan, for taking pattern.

Termes sp—Sugarcane in the Sabour farm was badly attacked with white ants. The crop was heavily irrigated with Crude oil emulsion.

Scirpophaga auriflua, zell. and Moth borer were reported from Khurda attacking sugarcane. A leaflet on the pest was forwarded.

Castor:—*Chrotogonus trachypterus, Bl.* appeared on young castor seedlings on the Sabour farm. It was controlled by kerosine and ash treatment.

Tobacco:—*Agrotis ypsilon Rott.* attacked tobacco seedlings in the Sabour farm. It was checked by heavy flooding.

Potato:—*Agrotis ypsilon, Rott.* was reported from Bhagalpur attacking potato plants. The area was visited and the proper method of picking demonstrated.

Phthorimœa operculella, Zell.—Potato moth was reported from Baptiahi attacking stored potatoes. The place was visited and the sand method of storage demonstrated.

Euzophera perticella, Rag.—Insect-affected stored potatoes sent from Ranchi were found to be attacked with Brinjal stem borer.

Vegetables:—*Green fly* attacking cabbages, etc, was reported from Patna Jail. Spraying with tobacco decoction was recommended.

Mango:—*Dacus persicæ, Rag.* Attacking ripe mangoes was reported from Bhagalpur. It was recommended to pick the fruits while green.

Jack fruit:—*Monophlebus stebbingi, Gr.*—A Jack fruit tree was reported from Bhagalpur. Ploughing under the tree during the rains and putting up sticky bands on the trunk early in winter were recommended.

Stored grains.—In the Sabour farm godown 796 maunds 23 seers of grains were fumigated with Carbon Bisulphide, of which 529 maunds were wheat and 22 maunds paddy. Ten thousand six hundred and twenty maize cobs and 26 varieties of Sweet Pea seeds were also fumigated.

Miscellaneous.—Besides the above, many reports of minor pests were received from the Province. Some ornamental plants in the Botanic Garden were treated for insect attack.

IV.—Teaching.

As the entomological course had always been elementary it was not affected by the revised college curriculum. I was responsible for the teaching of entomology and conducted the Diploma examination.

V.—Publications.

The following papers were published or prepared during the year:—

Title.	Author.	Where published
1	2	3
"Agrotis" at Colgong and Ghogha.	H. L. Dutt ...	Bihar & Orissa Agricultural Journal, Vol. III, No. 2.
"Agrotis" at Colgong and Ghogha 1915-16.	H. L. Dutt ...	In the Press.

H. L. DUTT,
Assistant Professor of Entomology.

No. 490-B., dated Sabour, the 26th July 1916.

From—The Economic Botanist to the Government of Bihar and Orissa, Sabour, E. I. R. (Loop),

To—The Director of Agriculture, Bihar and Orissa.

I have the honour to submit herewith the Annual Report of the work done in the Botanical Section during the year ending 30th June, 1916.

Annual Report of the work done in the Botanical Section during the year ending 30th June, 1916.

I.—Administration.

Charge.—Mr. E. J. Woodhouse, Economic Botanist, remained absent on military duty throughout the year and I remained in charge of the current duties of the Economic Botanist. Mr. H. L. Dutt remained in charge of the Entomological section.

Staff.—There has been only one change in the staff since I wrote my last report, namely, Babu Chintamani Rautraya, Garden Overseer, was allowed to accept the post of Manager of a Co-operative Bank in his native district in January last and the post of Garden Overseer has been kept vacant since then. Babu Jamini Bhusan Sinha, Mycological Fieldman, completed his training at Pusa and returned to Sabour on the 30th September 1915. For nearly two months in April and May, 1916, he was on deputation in connection with the Jute forecast work at Purnea.

Leave.—The following officers were allowed to enjoy privilege leave during the year:—Babu Jamini Mohan Talukdar, from 25th April, 1916, to 10th June, 1916; Babu Mahendra Chandra Bhar, from 1st May, 1916, to 3rd June, 1916; Babu Bhuban Mohan Sinha, from 2nd May, 1916, to 21st June, 1916. Six months' leave without pay was granted to Babu Chintamani Rautraya with effect from 12th January, 1916.

Office.—A large number of letters were received and answered. In all 2,139 letters were dealt with. In the accounts department, besides the pay of the establishment, Rs. 5,518-8-6 passed through the office in contingencies and travelling allowances. As usual a large number of seeds, plants and cuttings have been supplied to the public through the office. The office staff worked satisfactorily.

II.—Scientific and Research.

Mr. A. C. Ghosh continued the study of the Millets and the Pulses. Some progress has been made towards the preparation of a paper on *Kauni (Setaria italica)*. The publication of a memoir on the *Phaseolus Spp.* has also been kept in view, and it is hoped, will be completed this year. The peas and the sweet peas were carried on in pure culture and some more hybridisation work was done with these crops. Progress has also been made in the preparation of a paper on sweet peas and a preliminary note has been sent to the press. The varieties of Soybean and Sugarcane were continued in pure culture. The Rotation experimental crops were cultivated according to the cropping scheme.

In the Herbarium 92 additions have been made which make a total of 3,316 specimens mostly collected from the neighbourhood of Sabour, Colgong and Sahebgunj. Some further progress has been made by Babu Debabrata Mukharji in the compilation of the Sabour Flora and nearly half of it has been completed. Observations were again taken by Babu Jamini Mohan Talukdar on the growth of sugarcane and the flowering of perennials and the study of the life history of some local plants was continued. As usual the services of the draftsman and the photographer were largely utilized in making drawings and in taking photographs of botanical interest. Specimens were also collected for the Museum.

III.—Botanic Garden.

In the Botanic Garden the usual routine duties were carried on. The plants in the Morphological area were rearranged on account of the change in the level crossing. Some plants were added to the Natural Order beds and a bed of free flowering roses was made last winter. An attempt is being made, at present on a very small scale, to introduce such fruits as Apples, Pears, Peaches, Plums, etc. Grafts of such varieties as are known to fruit in the plains of India were obtained from Saharanpur and planted in the Botanic garden. Four grafts of Nagpur oranges, kindly supplied by Mr. Graham, were also planted in the Botanical garden for trial.

The total recurring expenses of the Botanical garden incurred during the year amounted to Rs. 4,144-4-10. The demonstration vegetable garden was maintained at a cost of Rs. 210-15-3, during the year. The income of the Botanical and the vegetable garden from all sources amounted to Rs. 259-5-5.

The work on the college grounds was supervised by the Botanic garden staff. A report on this work was submitted to the Principal for incorporation in his report.

His Honour the Lieutenant-Governor visited the Botanic Garden on the 14th February, 1916, and the Director of Agriculture, Bihar and Orissa, visited it twice during the year.

IV.—Mycology.

Diseased specimens of Potato, Gram, Chillies, Betelvines, Wheat, Linseed, Sweet pea, Oats, Barley, Marua (*Eleusine coracana*), Maize, Rahar (*Cajanus indicus*) Paddy and Jowar (*Andropogon sorghum*) were received and examined in the laboratory and enquiries regarding crop diseases were answered. Some specimens of sterile *Jowar* were sent to Pusa for examination.

V.—Education.

The teaching of Elementary General Botany, Mycology, Horticulture and Plant Breeding was carried on as usual. Owing however to the change in the educational policy of the college considerable reduction has been effected in the course of General Botany to take effect from the current academical year. The Diploma examination in Botany was held in March last and the result was duly notified to the Principal. Mr. Graham of Nagpur again acted as the external examiner.

VI.—Publications.

The following papers have been published or have been prepared for publication during the year by the officers of the Botanical section :—

Title.	Author.	Where published.
1	2	3
Cultivator's method of storage of seeds of Field crops as Cereals, pulses, etc. and seed-testing in Bihar.	A. C. Ghosh ...	Agricultural Journal, Bihar and Orissa, Vol. III, No. 2.
The Sweet pea (*Lathyrus odoratus*) in the Flower Garden.	A. C. Ghosh ...	In the Press.
Some observations on the flowering time of perennials growing at Sabour.	D. Mukharji and J. M. Talukdar.	Ditto.

S. K. BASU,

Assistant Professor of Mycology in-charge.

No. 508, dated Sabour, the 19th August 1916.

From—The Professor of Agriculture, Sabour, East Indian Railway (Loop),

To—The Director of Agriculture, Bihar and Orissa.

In compliance with your letter No. 6037-1R-24-16, dated the 28th July 1916, I have the honour to submit my detailed Annual Report for the year ending 30th June, 1916, for your perusal.

Annual Report of the Professor of Agriculture, Sabour.

I.—General.

Charge and Staff.—Throughout the year under review, I held charge of the work of the Professor of Agriculture in addition to my own duties.

Mr. B. M. Chattarji, remained the Superintendent of the Sabour Farm. Babus Jagat Mohan Datta and Ajodhya Prasad Ghose were the 1st and 2nd Overseers throughout the year, the latter with the exception of one month and 20 days (from 15th April to 5th June, 1916) when he was on jute enquiry work at Purnea. Munshi Ulfat Hossain acted as 3rd Overseer of the Farm till 14th May, 1916, when he resigned and Babu Ambica Datta Jha acted in his place till 22nd June, 1916, when he was relieved by Babu Bejoy Kishore Mukharji, the 1 Overseer of the Bankipore Farm. Babu Rudranand Jha, the permanent farm clerk, worked till 11th November, 1915, when he left to join the position of a clerk in the offices of the Assistant Director of Agriculture, Bhagalpur Division and Professor of Agriculture. During his absence Babus Ambika Datta Jha and Kamlanand Jha acted in his place. But he had to revert to his former post on the farm on 22nd June, 1916. Babu Ashu Tosh Sanyal, the permanent clerk of the office of the Professor of Agriculture, looked after the joint offices of the Professor of Agriculture and the Assistant Director of Agriculture till 19th January, 1916, when he left my office to work solely for the office of the Assistant Director of Agriculture, the position under the latter offering better rate of increment ; and Babu Haridas Chattaraj, typist of the Principal's office, was appointed clerk in his place.

Leave.—Babu Ajodhya Prasad Ghose, the probationary 2nd overseer, took medical leave for one month and 24 days from 1st September, 1915. Munshi Ulfat Hossain, the 3rd Overseer, took privilege leave for 2 months from 9th December, 1915 and Babu Nagendra Nath Banarji temporarily acted in his place. Babu Rudranand Jha, the farm clerk, took privilege leave for one month from 3rd July, 1915 and leave without pay for 3 months from 20th January 1916. Babu Haridas Chattaraj, the probationary clerk of the Professor of Agriculture, took privilege leave on medical grounds for two months from 21st April, 1916 and Babu Rudranand Jha, the farm clerk, acted in his place.

The constant changes in the offices of the Professor of Agriculture and the Farm Superintendent caused much inconvenience in the speedy disposal of office works and the only solution of the question seems to lie in the betterment of prospects of the clerical establishment under the Professor of Agriculture and this has already been pointed out in my last Annual Report.

Office work.—During the year 1,481 letters were dealt with. The account work was heavy. Rupees 18,696 passed as contingencies and travelling allowance through the offices under the Professor of Agriculture.

Training.—The Supernumerary Agriculturist, Babu Somesh Chandra Dutta, a Diplomate of the College, had his practical training on the farm. He joined on 9th July, 1915, and left on 31st May, 1916; during this period he was on medical leave for 35 days from 7th March to 10th April, 1916 and leave without pay from 19th to 27th May, 1916.

Tours.—Mr. B. M. Chattarji went to Pusa and Sepaya with the 1st and 2nd year students for 7 days in February, 1916. Several minor tours were made by Babu J. M. Dutta, the Senior Overseer of the farm, and Babu Somesh Chandra Datta, the Supernumerary Agriculturist on training, in connection with purchase and disposal of bullocks, purchase of buffaloes and crop-cutting experiments.

Visitors.—His Honour the Lieutenant-Governor of Bihar and Orissa and suite visited the farm in March.

The Director of Agriculture inspected the farm twice in July and February. Mr. Lyall, the Commissioner of the Bhagalpur Division, visited the farm on several occasions. The Inspector-General of Prisons, Bihar and Orissa, with the Civil Surgeon of Bhagalpur, visited the farm in May. The Deputy Director of Agriculture, Orissa Division and one of the Managers of the Peninsular Tobacco Company also visited the farm. At the instance of Mr. Lyall several zamindars of Bhagalpur visited the farm during the year.

The members of the Chanakya Society, accompanied by Mr. Horne, the Professor of Political Economy, Patna College, visited the farm in August and were shown round the whole farm and given many demonstrations.

II.—Education.

Theoretical and Practical work.—I was responsible for a course of lectures and practicums in Agriculture, Mensuration, Surveying and Zamindari given to all the general students of the College. The number of hours per week for class lectures was 7 and that of the field practicums, 27; and of these nearly 80 per cent. relate to Agriculture and the remainder to Zamindari Survey and Mensuration. The 3rd year students devised their own cropping scheme and managed the cultivation of their plots. The 2nd year students grew crops on their plots with their own hands, being assisted at times by farm labour. During the *Bhadoi* Season both the 2nd and 3rd year students grew Sanhemp for green-manuring and *Juar* for fodder; and during the *Rabi* Season the 3rd year students grew Wheat and Barley and the 2nd year students only Wheat. From the financial standpoint the results are not as satisfactory as should have been. Details of their cultivation are given in Table No. 1. The 1st year students' practical work continued on the same lines as those of last year. The live-stock management practicums were given to all the students as in the last year.

Object-lesson plots.—To demonstrate simple principles and practices of agriculture to the 1st year and Short-course students, a series of object-lesson plots were started during the year. The plots are 100′ × 20′ and number 33. They comprise generally the important agricultural practices and methods and the economic crops of the Provinces. Table No. 2 gives the names of the lessons that are intended to illustrate.

Examination.—The 1st and 2nd year students were examined in agriculture and allied subjects by me and the 3rd year students on agriculture by Mr. Allan, the Principal of the Nagpur Agricultural College and me during March 1916. Both the students in the Diploma course satisfied the external Examiner in agriculture.

Short-course students.—Three-Short course students during the *Bhadoi* and three during the *Rabi* Seasons had their practical training on the farm under the supervision of the Farm Superintendent. Two lectures per week on elementary agriculture in vernacular were also given to them by the Farm Superintendent. In agriculture they had 15 hours of practical work and 2 hours of lectures per week.

College Museum.—A start was made during the year for the preparation of suitable models, etc., for the Agricultural Section of the Museum. Sixty models of wood, iron, clay, and straw, etc., were made during the year. They are all of agricultural implements, tools and utensils, both indigenous and foreign. Sketch drawings and the photographs have also been made of them for writing-up of descriptive labels for them.

III.—Farm.

Situation.—The Sabour Agricultural Experiment Station is situated in latitude 25° 15′ 40″ North, and longitude 87° 2′ 42″ East, with an altitude of about 150 feet above sea level.

The farm lands lie on either side of the East Indian Railway line, to the east of the Sabour Railway Station at a distance of about quarter of a mile from it, the nearest large city being Bhagalpur 5 miles to the west.

Establishment and Control.—It was established in 1907 as the Home Farm of the Agricutural Department of Bengal, Bihar and Orissa, being connected with the Provincial Agricultural College at Sabour.

The Farm is under the immediate control and supervision of the Professor of Agriculture, and is managed by a Superintendent with a staff of three fieldmen-overseers and one clerk.

Laying out.—A considerable amount of laying-out work has been done on the farm during the year at a cost of about Rs. 6,026. The important works are:—Reclamation of the brick-field area and excavation of a tank therein, extension of the Implement-shed, construction of a Sluice-gate in the Northern Section and improvement round the pucca well and godown and inside the hay-shed. Details of the laying-out work with their objects and cost are given in Table No. 3.

Cropped Areas.—The Government Estate at Sabour has an area of about 320 acres of which about 190 acres are under farm administration.

The total cropped area of the farm amounted to about 156 acres. The slight increase in the cropped area over that of the previous year is due to the reclamation of land in the brick-kiln site.

Of the total cultivated area, 75·71 acres were under experimental cultivation and 2·60 acres under students' cultivation the rest being under general crops. And on seasonal crop basis the cropped area of the farm was distributed thus—103 acres under *Bhadoi*, 31 acres under *Aghani* and 144 acres under *Rabi* crops, 122 acres being double-cropped.

Employment and distribution of power.—The average labour and bullock force on the farm per day has been as follows:—

Ploughman per day ...	...	19·0
Cattleman per day ...	...	5·9
Casual labour per day ...	Men ...	15·3
	Women ...	14·9
	Boys and girls ...	13·2
Blacksmith, per day ...	...	0·7
Carpenter, ,, ...	...	0·7
Other kinds, ,, ...	...	1·1
Watchmen ,, ...	...	3·8
Mates ,, ...	...	4·5

The bullocks worked on an average of 9·7 pairs per day.

The Engine worked in thrashing crops for 93 hours, 21 hours for paddy and 72 hours for *Rabi* crops.

The monthly distribution of labour and bullocks on the farm has been shown in Table No. 4.

Character of the Season.—The season on the whole was not so bad as that of the last year. The total rainfall was 47·52 inches and was fairly well distributed. But the relatively heavy rain in November, about 1·79″ in one day, did some damage to the *Aghani* and *Rabi* crops. The rainless condition in May will prejudicially affect the *Bhadoi* crops of the next year. The season was also favourable for the mango crop and a good harvest was reaped. Table No. 5 gives the distribution of rainfall during the year.

Soil and its amendments.—Table No. 6 gives in a general way the chemical composition of the soils of the main blocks of the farm so far as their essential soil-constituents are concerned. The chemical composition shows that they vary between wide limits and generally, in most cases, lack nitrogen rather than potash or phosphoric acid. Generally there are two main types of soil on the farm, viz., Loamy (Pasrotti or Dorash) and clayey or clay-loam ('Karar' or 'Kewal').

The upland ('Tikar') soils of the farm are all of a loamy nature but some of them are so bad from a physical stand-point that they settle down very readily after a heavy shower of rain, thus seriously affecting the condition of

the crops standing on them especially if they are very young. Patches of alkali soils (' Usar or Kharwoa ') are to be found in some plots of the Southern Section. The homstead lands (Dih or Basti) of the farm are very rich and always give two good crops in a year without the application of any manure or fertilizer. The lowland (Chaur) soils are more heavy, generally of a clayey nature and paddy is usually grown on them. Fine tilth on ' char-lands ' is not always possible unless handled very carefully and in time ; and as the surface hardens very badly during the *Rabi* season, drilling is always to be done if good results are to be expected.

To enrich the soils of the farm a scheme was developed at the suggestion of the Director of Agriculture, Bihar and Orissa, to manure all the farm lands with cattle manure as far as possible. As a result of this, a large area of the farm has thus been treated and arrangements have been made with the neighbouring cultivators for supply of their manure to farm in exchange for fuel (Rahar stalks, etc.). Table No. 7 gives some information regarding the manurial substances that were used on the farm during the year.

Crops.—During the year the following chief crops were grown for general and experimental purposes :—paddy, maize, juar, marua, wheat, barley, oat, rahar, gram, pea, khesari, cowpea, kalai, kulthi, meth, mustard, Sanhemp, jute, dhaincha, sugarcane, tobacco and carrot.

Table No. 8 gives the name of crops with their acreages, objects and seed rates and Table No. 9 gives the outturn of the principal crops of the farm grown during the year as compared with their yields of previous years. From this it will be evident that the harvest of the year was fairly a good one. The *Bhadoi* harvest had been very satisfactory especially the maize, aus paddy Sanhemp (for fibre) and juar (for fodder) crops. So satisfactory had been the yield of juar fodder that the large pucca silo and 8 kutcha siloes could all be filled up with silage. About 146 tons and 13 cwt. of green juar were thus utilized in silaging and fodder purposes and throughout the year there had been no fodder difficulty. As in the previous year, odd strips of land, orchard areas, and newly reclaimed lands in the brick-field area were utilized in growing fodder crops.

Experiments.—There was very little change in the experimental works of the farm which were carried on the same lines as those of the previous year. Table No. 10 gives some particulars of the farm experiments conducted during the year.

This year's results of farm experiments are given below :—

1. Hot-weather cultivation experiment.

Serial No.	Treatment.	Crop.	Area.	Outturn in lbs.		Remarks.
				Grains.	Straw.	
1	2	3	4	5	6	7
1	Cultivated only in April with the country plough.	Wheat Pusa No. 12.	0·15	75·0	148·0	
2	Cultivated only in April with Punjab plough.	,,	,,	117·0	212·0	
3	Cultivated with the country plough in April and again at intervals of three weeks.	,,	,,	93·8	173·8	
4	Do. with the Punjab plough ...	,,	,,	100·0	224·0	
5	Cultivated with the Punjab plough in April and manured with 8·200 lbs. cattle manure per acre.	,,	,,	143·0	228·8	
6	Do but cultivated at intervals of three weeks.	,,	,,	107·0	156·0	
7	No hot-weather cultivation but 8·200 lbs. of cattle manure applied per acre.	,,	,,	59·0	99·8	
8	No hot-weather cultivation and no manure.	,,	,,	56·0	101·0	

The conclusions drawn last year appear to apply this year also.

2. Seedling experiment with paddy. Area=$\frac{1}{40}$th acre. Variety= *kalamdan.*

The experiment was conducted exactly in the same way as in the last year and taking into account all the factors involved in the experiment.

From this year's results, the same conclusions may in a general way be drawn as last year with the following exceptions :—

(*a*) That strength of seedlings appears to be unaffected with the density of the seed bed. But with the same density, the productive strength appears to be slightly increased by the application of manures. Wet seed-bed seedlings did badly this year as the plots were water-logged for a long time.

(*b*) That in the manured plot the total yield appears to be relatively small owing to excessive vegetative growth which caused lodging.

(*c*) That the spacing (6″) plots had very favourable conditions and therefore the difference between the "Single and Bunch" transplantation is very slight as also the total yield is very high.

This year's results are given in the following table :—

Serial No.	Factor in the experiment.	Average outturn in pounds.				Remarks.
		1 and 2 seedlings.		4 and 6 seedlings.		
		Grain.	Straw.	Grain.	Straw.	
1	2	3	4	5	6	7
		Lbs. oz.	Lbs. oz.	Lbs. oz.	Lbs. oz.	
1	Unmanured seed bed, seed rate 164 lb per acre.	23 7	72 5	29 0	72 7	
2	Manured seed bed, seed rate 164 lb per acre.	25 2	62 12	32 0	76 4	
3	Unmanured seed bed, seed rate 328 lb per acre.	23 6	59 4	29 8	72 8	
4	Manured seed bed, seed rate 328 lb per acre.	23 4	64 13	29 10	81 15	
5	Unmanured seed bed, seed rate 820 lb per acre.	25 7	64 11	28 4	77 12	
6	Manured seed bed, seed rate 820 lb per acre.	30 14	81 9	31 12	91 0	
7	First transplantation, age of seedlings 6 weeks.	20 1	101 7	41 0	112 11	
8	Second transplantation, age of seedlings 6 weeks.	26 0	88 10	32 10	101 13	
9	Second transplantation, age of seedlings 8 weeks.	34 0	78 7	38 3	95 7	
10	Third transplantation, age of seedlings 6 weeks.	25 2	62 15	28 12	71 0	
11	Third transplantation, age of seedlings 8 weeks.	25 14	53 0	31 4	62 2	
12	Third transplantation, age of seedlings 10 weeks.	25 0	46 10	31 10	66 2	
13	Fourth transplantation, age of seedlings 6 weeks.	24 8	47 9	29 0	61 3	
14	Fourth transplantation, age of seedlings 12 weeks.	18 12	32 14	23 4	43 6	

Serial No.	Factor in the experiment.	Average outturn in pounds.				Remarks.
		1 and 2 seedlings.		4 and 6 seedlings.		
		Grain.	Straw.	Grain.	Straw.	
1	2	3	4	5	6	7
		Lb. oz.	Lb. oz.	Lb. oz.	Lb. oz.	
15	Seedlings from wet seed bed ...	6 3	22 5	5 10	24 10	
16	„ from dry „ „ ...	21 8	49 1	25 8	72 4	
17	Manured 8200 cow-dung + 820 lb castor cake per acre.	31 10	143 14	37 10	165 2	
18	Spacing 6 inches	40 2	116 15	40 6	119 11	
19	„ 9 „	23 8	71 3	29 0	105 0	
20	„ 12 „	14 6	68 8	21 15	82 1	
21	„ 18 „	12 14	68 8	16 8	65 2	

3. Date of planting with paddy seedlings:—

Area $\frac{1}{10}$th acre. Variety—Kalamdan.

Factor in the experiment.	Outturn in pounds.								Remarks.
	2 seedlings.		3 seedlings.		4 seedlings.		6 seedlings.		
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	
1	2	3	4	5	6	7	8	9	10
	Lb. oz.	Lb. oz.	Lb. oz.	Lb. oz.	Lb. oz.	Lb. oz.	Lb. oz.	Lb. oz.	
10th July transplantation.	95 0	235 0	107 0	207 0	138 0	269 0	125 0	246 0	
25th July transplantation.	71 0	180 8	123 0	222 0	86 0	208 0	122 0	203 0	
10th August transplantation.	40 4	73 0	44 0	90 12	43 0	81 0	73 0	123 0	
25th August transplantation.	54 0	100 0	54 0	101 0	54 0	110 0	96 0	143 0	

Last year's conclusions appear to hold good this year also excepting that this year the bunch transplantation of 6 seedlings gave better results than either 2, 3 or 4 in the last transplantation.

4. Green manuring with paddy.

A. Successive green manuring with Sanhemp.

Area $\frac{1}{10}$th acre. Variety—Dahia.

Green manuring once in 4 years.		Green manuring twice in 4 years.		Green manuring thrice in 4 years.		Green manuring 4 successive years.		Green manuring once and liming twice in 4 years.	
Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.
1	2	3	4	5	6	7	8	9	10
Lb. oz.	Lb. oz.	Lb. oz.	Lb. oz.	Lb. oz.	Lb. oz.	Lb. oz.	Lb. oz.	Lb. oz.	Lb. oz.
64 0	134 8	77 8	173 6	84 0	160 0	167 0	319 4	87 0	166 0

B. Alternate and continuous green manuring with Sanhemp in conjunction with lime and bone-meal.

Area $\frac{1}{20}$th acre. Variety—Dahia.

Factor in the experiment.	With lime.		With bone-meal.		Green manuring alone.	
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.
1	2	3	4	5	6	7
	Lb. oz.	Lb. oz.	Lb. oz.	Lb. oz.	Lb. oz.	Lb. oz.
Alternate green manuring ...	99 0	291 12	99 2	302 7	81 13	258 4
Continuous green manuring ...	115 12	384 4	119 8	331 0	97 6	328 8

C. Successive green-manuring with Dhaincha.

Area $\frac{1}{10}$th Acre. Variety—Kajerghore.

No green manuring in 4 years.		Green manuring once in 4 years.		Green manuring twice in 4 years.		Green manuring thrice in 4 years.		Green manuring twice + liming twice in 4 years.	
Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.
1	2	3	4	5	6	7	8	9	10
Lb. oz.	Lb. oz.	Lb. oz.	Lb. oz.	Lb. oz.	Lb. oz.	Lb. oz.	Lb. oz.	Lb. oz.	Lb. oz.
113 0	307 0	113 0	245 0	127 0	273 0	145 0	316 0	114 0	352 0

It is evident from above that green manuring of paddy lands is generally attended with good results and that application of lime and bone-meal increases the effect to some extent and that continuous green manuring has good rather than any prejudicial effect.

5. Residual effect of Rock-phosphate.

As the material was not available this year its residual effect was studied.

Area 0·16 acre. Crops—Maize and Mustard.

Factor in the experiment.	Outturn of maize.		Outturn of mustard.		Remarks.
	Grain.	Straw.	Grain.	Straw.	
1	2	3	4	5	6
	Lb. oz.	Lb. oz.	Lb. oz.	Lb. oz.	
Rock phosphate and lime applied in April	177 10	775 0	23 10	79 2	The mustard crop was a very bad one due to weather conditions.
Ditto ditto in May	175 2	704 0	13 8	37 6	
Ditto ditto in Sept.	164 12	728 0	23 10	53 4	
Rock phosphate applied in April ...	182 12	712 8	38 2	83 8	
Ditto in May ...	183 14	681 0	28 8	86 10	
Ditto in September ...	160 10	777 8	36 0	96 12	
Lime applied in April	177 8	705 0	15 8	36 0	
Ditto in May	182 6	730 0	13 8	60 14	
Ditto in September	232 2	872 0	32 0	96 0	
No fertilizer	155 10	646 4	32 2	66 10	

This year the residual effect of the rock-phosphate was more marked on maize than in the previous year. Also last year's deduction, viz., that rock-phosphate with lime appears to be of no material advantage, seems to hold good this year also. Also the residual effect of liming is very marked.

6. Liming on Marua and Oat.

Area 0·15 acre Crops.—Marua and Oat.

Factor in the experiment.	Outturn of marua.		Outturn of oat.	
	Grain.	Straw.	Grain.	Straw.
1	2	3	4	5
	Lb. oz.	Lb. oz.	Lb. oz.	Lb. oz.
Five maunds slaked lime every alternate year ...	80 0	325 14	117 0	240 0
Five maunds quick-lime every alternate year ...	87 8	283 8	164 0	233 0
Five maunds slaked lime every 3 years ...	88 4	232 12	130 0	292 0
Five maunds quick-lime every 3 years ...	62 0	218 3	116 0	217 0
Five maunds quick-lime every year	81 0	228 10	159 0	290 0
No lime	70 6	193 14	105 0	185 0

No definite conclusion can be drawn from the above figures. It appears that liming has some good effect both on Marua and Oat.

The relative value of slaked and quick-lime is not decided.

But it seems that liming every year does not serve any useful purpose.

7. Date of sowing Rahar.—

Area = $\frac{1}{10}$th acre. Crops—Saran and Local Rahar.

Factor in experiment.	Outturn in pounds.						Remarks.
	Saran.			Local.			
	Grain.	Bhusa.	Staks.	Grain.	Bhusa.	Stalks.	
1	2	3	4	5	6	7	8
	lb. oz.	lb. oz.	lb. oz.	lb oz.	lb. oz.	lb. oz.	
May sowing	82 0	209 8	581 0	66 0	179 0	520 0	
June „	72 4	215 0	670 0	57 4	164 8	544 0	
July „	93 0	253 0	1,335 0	89 2	245 0	1,191 10	

This year the late sowing gave better results than the early sowing in each case.

8. Method of planting paddy.—

AREA=$\frac{1}{10}$TH ACRE. CROP—KAJERGHORE, C. P. AUS AND BENIBHOG PADDY.

Factor in experiment.	Kajerghore.		C. P. Aus.		Benibhog.		Remarks.
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	
1	2	3	4	5	6	7	8
	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	
Broad Cast	65 0	130 0	26 8	98 6	51 0	473 0	
Dibbling	48 4	103 0	23 6	99 8	65 8	467 0	
Transplanting	131 8	279 0	58 8	214 10	91 12	546 4	

From the above results, the superiority of transplantation over broa-cast sowing and dibbling is very evident.

9. Green-manuring and liming of mustard lands.—

AREA=$\frac{1}{2}$ ACRE CROP MUSTARD (MAGHI-GOTA).

Factor in experiment.	Outturn in pounds.		Remarks.
	Grain.	Stalks, etc.	
1	2	3	4
	lbs. oz.	lbs. oz.	
No manure	57 8	149 0	
Green manure with Sanhemp	89 10	195 8	
Green-manuring and liming	135 0	283 0	

As in last year the effect of green-manuring and green-manuring with liming appears to be better than no treatment.

10. Cropping on homstead lands.—

AREA=0·3 ACRE. CROP MAIZE, WHEAT, JUTE, TOBACCO AND MUSTARD.

Factor in experiment.	Bhadoi Season.		Rabi Season		money value.
	Fibre or Grain.	Straw, etc.	Grain or Leaf.	Straw, etc.	
1	2	3	4	5	6
	lb. oz.	lb. oz.	lb. oz.	lb. oz.	Rs.
Maize and Wheat ...	130 12	660 6	312 0	499 10	25
Jute and Tobacco ...	115 4	672 0	257 0	...	30
Maize and Mustard ...	233 10	852 14	260 10	319 4	27

Though from financial stand-point "jute and tobacco" is better than the other two systems, but it appears to be more risky as the price of the products is more subject to market fluctuations than in the other two cases. Besides, the tobacco crop is more susceptible to crop accidents than the others.

11. Variety-trial with Rahar.—

AREA=0·33 ACRE. CROP—RAHAR.

Rahar variety.	Outturn in pounds.			Remarks.
	Grain.	Bhusa.	Stalks.	
1	2	3	4	5
	lb. oz.	lb. oz.	lb. oz.	
Aghani	65 8	124 0	478 0	
Deshi	180 0	379 0	1,362 0	
Saran	182 10	387 0	1,408 0	The crop was not uniform.

The early (Aghani) variety is decidedly a poor yielder as compared with Deshi and Saran varieties.

12. Variety trial with wheat—

AREA=0·05 ACRE. CROP—WHEAT.

Wheat varieties.	Outturn in pounds.		Remarks.
	Grain.	Straw.	
1	2	3	4
	lb. oz.	lb. oz.	
Pusa No. 6	30 8	58 0	
„ „ 7	35 7	65 0	
„ „ 8	46 5	79 8	
„ „ 12	48 12	85 0	
„ „ 106	41 0	79 0	
Local	41 0	75 0	

The superiority of Pusa No. 12 over others is clearly seen.

13. Variety trial with Phillipine Paddy.

AREA=0·01 ACRE. CROP PADDY.

Paddy varieties.	Outturn in pounds.		Name and days taken to mature.
	Grain.	Straw.	
1	2	3	4
	lb. oz	lb. oz.	
P. No. 530	15 12	35 7	Macan pina ... ... 140 days.
„ „ 635	17 4	35 0	Mulanay ... ... 141 „
„ „ 813	16 0	43 6	Senora II ... ... 144 „
„ „ 663	14 0	37 4	Panni ... ... 145 „
„ „ 447	15 0	46 6	Inasimang ... ... 168 „
„ „ 692	13 10	82 6	Piniling Daniel ... 171 „
„ „ 527	5 8	90 12	Macan ... ... 178 „
Kalmadan	16 1	36 13	

14. Soil-fertility trials—

These trials were continued on the same lines as those of the last year.

15. Observational experiments with paddy.

The general conclusion arrived at last year on the longivity of uprooted paddy seedlings, the economic limit of seedlings per hole in transplantation root-pruning of seedlings, paddy cuttings and transplantation of tillerings, seems to apply this year also.

The result of another experiment on the performance of different seedlings of the same and different seed-beds appears to indicate that there is no very great difference in the power of performance of seedlings from different seed rate seed-beds.

Receipts and expenditure of the Farm :—

The total expenditure in running the farm during the year amounted to Rs. 20,710-4-11 of which Rs. 6,047-15-4 can strictly be called cultivational charges, the remainder being spent on supervision, office expenses, and non-recurring charges like purchase of bullocks and implements, construction of tank and sluice gate and other minor laying out and constructional works on the farm. The net receipts of the farm amounted to Rs. 6,385-4-1, an improvement of Rs. 2,870-8-0 over last year's receipts. The following statement gives particulars of the receipts and expenditure of the farm for the year ending 30th June 1916 :—

Statement showing receipts and expenditure of the Sabour Farm for the year 1915-16.

Receipts.	Rs.	a.	p.	Rs.	a.	p.
Sale proceeds of farm produce ...				4,615	9	11
Miscellaneous receipts				235	14	9
Sale of old stores				211	3	0
Value of produce in hand (1915-16) ...				3,668	15	6
Amount of outstanding bills ...				328	0	6
Gross receipts				9,059	11	8
Deduct :—						
Value of old produce (1914-15)... ...	2,412	9	7			
Amount of outstanding bill on 1st July 1915 and since realized ...	261	14	0			
	2,674	7	7	2,674	7	7
Net receipts				6,385	4	1

Expenditure.	Rs.	a.	p.
1. *Non-recurring.*			
Purchase of cattle	2,110	5	3
Purchase of implements and construction of implement shed... ...	2,349	11	0
Laying out	4,200	7	1
Railway and Steamer freight ...	59	5	0
2. *Recurring.*			
(*a*) Office expenses—			
Service postage, etc.	25	4	0
Hot weather charges	26	10	0
Office contingencies	302	11	9
Miscellaneous	214	4	6
(*b*) Superintendence and Control— Establishment	5,245	6	3
(*c*) Experimental— Purchase of fertilizers... ...	128	4	9
(*d*) Cultivation— Feed of cattle	751	13	9
Purchase of seed	178	7	9
Wages of cultivation	5,117	9	10
Total Expenditure ...	20,710	4	11

IV.—College Dairy.

The number of the dairy herd on June 30th 1916 stood as follows. 4 bulls, 13 cows, and 22 young stock consisting of heifers, bull and cow calves. 13 calves were born during the year and added to the stock. A number of dairy animals was sold during the year. Three cows with five heifers and calves were eliminated as their performance records were too poor to justify their retention in the herd. The four bulls disposed of during the year were meant for breeding purposes outside. Table No. 11 gives particulars of the disposal of the dairy animals. At the instance of Mr. Milligan, the Imperial Agriculturist, the farm bred breeding bull Kansa No. 12-S was exchanged for another equally good bull Bipathari No. 103-P. from Pusa.

The general health and condition of the dairy herd was very satisfactory during the year and there had been no death nor an outbreak of any epidemic in the herd.

The silage made for the farm live-stock was very good and lasted till June. Table No. 12 gives the composition of the different kinds of feeding stuffs used on the farm.

The milk yield of the herd amounted to 18,780½ lb. valued at Rs. 896-12-0. The net receipts of the dairy amounted to Rs. 1,538-9-6, an increase of Rs. 311-1-9 over last year's receipts. The details of the receipts and expenditure are given below.

Statement showing receipts and expenditure of the College dairy 1915-16.

Receipts.	Rs. a. p.	Expenditure.	Rs. a. p.
Sale of milk and stock	1,728 4 0	Attendance	320 7 6
Outstanding bills	161 7 0	Coarse feed	1,053 14 3
	1,889 11 0	Concentrate and salt	729 13 11
Deduct—		Appliances	0 7 6
Outstanding bills on 1st July 1915 and since realized	351 1 6	Medical treatment	63 6 6
		Miscellaneous	46 10 6
Net receipts ...	1,538 9 6	Total ...	2,214 12 2

The following statement gives the valuation figures of the present dairy stock. From this it will be seen that the stock has increased in value to the estimated amount of Rs. 327.

Valuation statement of the Sabour dairy herd (1915-16).

Kind of stock.	Valuation in—		Increase (+) Decrease (—)	Remarks.
	1914-15.	1915-16.		
	Rs. a. p.	Rs. a. p.	Rs. a. p.	
Old herd at Rs. 10 per cent. depreciation.	658 5 3	425 5 3	—233 0 0	Three cows for Rs. 186 were sold during the year.
Value of the stock raised during 1912-13.	1,500 0 0	1,530 0 0	+30 0 0	One bull for $\frac{Rs.\ 125}{Rs.\ 100}$* of this stock was sold during the year.
Value of the stock raised during 1913-14.	570 0 0	930 0 0	+360 0 0	One bull for Rs. 100 and 2 cow-calves for $\frac{Rs.\ 92}{Rs.\ 40 + Rs.\ 30}$* of this stock were sold during the year.
Value of the stock raised during 1914-15.	180 0 0	350 0 0	+170 0 0	Three cow calves for $\frac{Rs.\ 138}{Rs.\ 60}$* of this stock were sold during the year.
Value of the stock raised during 1915-16.	...	164 0 0	...	Three calves were sold during the year.

*The figures italics were their valuation in 1914-15 and the figures in roman are the amount for which they were actually sold.

V.—Exhibition.

Exhibition.—Three circle exhibits were prepared during the year in accordance with the recommended list of the Department and the usual routine work in the collection and preparation of crop samples, fertilizers etc., repair of plates and diagrams, printing of labels and despatch of these exhibits with English and vernacular leaflets to Purnea, Katihar and Ranchi, had to be done. Babu Ashutosh Sanyal, Clerk of the Office of the Professor of Agriculture, did much painstaking work in this direction, there being no separate staff at Sabour to do this work.

Babu Nibaran Chandra Chowdhury, the Travelling Inspector of Agriculture, was deputed for a few weeks to look to the over-hauling of old exhibits but the time at his disposal had been so short that no substantial work could be done in this direction. But if it could have been arranged to depute him or any other person here during the whole exhibition season viz., from October to March it would have been of substantial help to me in the Exhibition work. Rs. 500 was sanctioned as usual for the collection, preparation, etc., of the exhibits and the expenditure incurred for this work during the year amounted to Rs. 413-11-9.

Leaflets.—As the leaflets of the Department are getting old, a scheme was prepared and submitted to the Director of Agriculture, Bihar and Orissa, for their revision so as to make them up-to-date.

Magic-Lantern Slides.—At the suggestion of the Director of Agriculture Bihar and Orissa, a scheme was prepared for the renewal of the Department's magic-lantern slides after examining all the slides now in possession of the Agricultural Inspectors. The scheme has been approved by the Director of Agriculture, Bihar and Orissa and about 30 slides have been prepared.

VI.—Extension.

On the appointment of Mr. Robinson as Assistant Director of Agriculture, Bhagalpur Division, the extension work of the Professor of Agriculture has been considerably diminished.

Pusa wheat storage and despatch.—19 cwt. of Pusa wheat were received from Sonbarsa Raj and stored in the farm godown. 134 cwt. of Pusa wheat stored here were despatched to different people with the assistance of farm people as desired by Mr. Robinson.

The storage and distribution of seed both for the requirements of the farm other officers of the Department and outside people may be very conveniently and efficiently done if a seed-godown is established at Sabour with necessary equipment and a Seed-store Keeper appointed as pointed out previously.

Demonstrations.—At the instance of Mr. Lyall, the Commissioner of Bhagalpur, the members of the Co-operative Credit Society of the neighbouring villages of Farka-Inglish were taken over to the farm by the Sub-Deputy Collector in charge. Demonstrations on the improved methods of cultivation silage-making, etc., were given to them by farm. At the Commissioner's suggestion, a plough demonstration was arranged in Farka-Inglish and the Senior Farm Overseer with the necessary labour staff of the farm was sent there for the purpose. The demonstration was a success but the Meston plough did not make much impression on the cultivators who rather preferred the Hindustan and Punjab ploughs. At the instance of Mr. Robinson, two farm ploughmen were sent to the neighbouring villages to teach people to fit up and use the Punjab plough, and one ploughman with a Punjab and Hindustan plough was sent to the Sonbarsa Raj for demonstration purpose. A ploughman of a Bhagalpur Zamindar was trained on the farm in the practical handling of the Punjab plough. Two Punjab ploughs and a Sugarcane Mill were sent to Pakur and Madhipura for demonstration purpose and six Meston ploughs were sold through Mr. Robinson. As usual, farm ploughmen were sent to different Exhibitions to assist in the demonstrations.

Improvement of local cattle.—With the approval of the Director of Agriculture, Bihar and Orissa, the cattle of the neighbouring villagers were admitted within the farm enclosure for service by the farm breeding bulls. 20 cows were thus served during the year. Farm breeding bulls were also sold during the year to District Boards, etc., for the same purpose. Particulars of the animals distributed during the year are given in table No. 11A.

Seed Supply.—A large amount of seeds of different varieties was indented during the year. The quantity of seeds supplied amounted to about 19,212 lb, besides, some Marua and paddy seedlings and sugarcane cuttings.

Table No. 11B gives the quantity and quality of seeds indented and supplied during the year.

Crop-Cutting Experiments.—63 crop cutting experiments were done in the neighbourhood of Sabour with various *Bhadoi*, *Aghani* and *Rabi* crops and results submitted to the Director of Agriculture, with suggestions for improvement in the conduct of such work in future.

Acknowledgments.—Thanks are due to Mr. C. S. Taylor, Agricultural Chemist to the Government of Bihar and Orissa, for kindly analysing many fertilizers, manures and feeding stuffs given in this report and to the Economic Botanist for making arrangements to combat with crop pests on the farm and in the Godown. Thanks are also due to Mr. Allan, Principal, Nagpur Agricultural College, for the present of some models of indigenous agricultural implements for the College Museum and to Mr. Sethi, the Deputy Director of Agriculture, Orissa, and the Bombay and Madras Departments of Agriculture for kindly undertaking to make some models of indigenous agricultural implements for the College Museum.

S. N. SIL,

Assistant Professor of Agriculture in-charge.

Table No. 1.

Showing the cost of cultivation, outturn, profit, loss, etc., of the Student's area for the Bhadoi Season during the year 1915-16.

Serial number.	Names of Students.	Class.	Plot number.	Area.	Crop.	Cost of cultivation.		Total cost.	Outturn.	Rate per 28·23 lb.	Value of outturn.	Profit.	Loss.	Remarks.
						Personal labour.	Farm labour.							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
						Rs. a. p.	Rs. a. p.	Rs. a. p.	lb.—oz.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
1	K. Gordon ...	2nd year	A 44	0·20	Dhaincha ...	1 1 3	0 0 4	1 1 7	...	...	...	...	...	Ploughed in.
2	Debi Prasad Gohain...	Ditto	A 45/1	0·10	Juar ...	0 13 8	0 4 4	1 2 0	561—9	0 2 0	0 13 7	...	0 4 5	
3	Ditto ...	Ditto	A 45/2	0·10	Sanhemp ...	0 14 3	0 2 3	1 0 6	...	...	...	...	...	Ploughed in.
4	Brojo Gopal Das ...	Ditto	A 46/1	0·10	Juar ...	0 11 11	0 5 2	1 1 1	631—8	...	0 15 4	...	0 1 9	
5	Ditto ...	Ditto	A 46/2	0·10	Sanhemp ...	1 1 1	0 1 5	1 2 6	...	...	...	...	...	Ploughed in.
6	Dinesh Chandra Das	Ditto	A 47/1	0·10	Juar ...	0 9 3	0 3 9	0 13 0	824—13	...	1 4 0	0 7 0	...	
7	Ditto ...	Ditto	A 47/2	0·10	Sanhemp ...	0 15 5	0 0 9	1 0 2	...	...	...	...	...	Ploughed in.
8	R. Buckley ...	3rd year	A 36	0·30	Ditto ...	...	2 2 4	2 2 4	...	...	...	...	...	Ploughed in.
9	Nirmal Chandra Deb	Ditto	A 33	0·30	Ditto ...	...	2 2 4	2 2 4	...	...	...	...	...	Ploughed in.
10	R. Buckley ...	Ditto	A 34,35	0·60	Juar ...	...	4 9 2	4 9 2	1,386—6	...	2 1 9	...	2 7 5	
11	Nirmal Chandra Deb	Ditto	A 31, 32	0·60	Do. ...	...	4 0 1	4 0 1	617—1	...	0 15 0	...	3 1 6	0·30 acre Juar failed.

Table No. 1—contd.

Showing the cost of cultivation, outturn, profit, loss, etc., of the Student's area for the Rabi Season during the year 1915-16.

Serial number.	Names of Students.	Class.	Plot number.	Area.	Crop.	Cost of cultivation.		Total cost.	Outturn.		Rate per 82·28 lbs.		Value of outturn.	Profit.	Loss.	Remarks.
						Personal labour.	Farm labour.		Grain.	Straw.	Grain.	Straw.				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
						Rs. a. p.	Rs. a. p.	Rs. a. p.	lb.—oz.	lb.—oz.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
1	K. Gordon ...	2nd year	A 44	0·20	Pusa wheat No. 6.	3 2 4	0 7 8	3 10 0	71—15	123—6	4 0 0	0 4 0	3 14 0	0 4 0	...	Cost of green manuring in Bhadoi included in Rabi.
2	Debi Prasad Gohain.	Ditto	A 45	0·20	Ditto	2 12 9	0 12 0	3 9 6	79—12	64—13	4 0 0	0 4 0	1 15 8	...	1 9 10	Ditto.
3	Brojo Gopal Das	Ditto	A 46	0·20	Local wheat	2 8 4	0 13 1	3 5 5	70—5	125—7	4 0 0	0 4 0	3 12 9	0 7 4	...	Ditto.
4	Dinesh Chandra Das.	Ditto	A 47	0·20	Ditto	2 5 11	0 13 4	3 3 3	70—15	130—9	4 0 0	0 4 0	3 13 6	0 10 3	...	Ditto.
5	R. Buckley ...	3rd year	A 36	0·30	Pusa wheat No. 106.	...	6 11 11	6 11 11	115—2	206—3	4 0 0	0 4 0	6 2 7	...	0 9 4	Ditto.
6	Nirmal Chandra Deb.	Ditto	A 33	0·30	Pusa wheat No. 7.	...	6 11 11	6 11 11	166—9	308—8	4 0 0	0 4 0	9 0 7	2 4 8	...	Ditto.
7	Ditto ...	Ditto	A 31	0·30	Local wheat	...	4 9 7	4 9 7	213—14	359—15	4 0 0	0 4 0	11 7 11	6 14 4	...	
8	R. Buckley ...	Ditto	A 34,35	0·60	Local barley.	...	9 6 5	9 6 5	106—15	183—1	3 0 0	0 4 0	4 7 5	...	4 15 0	
9	Nirmal Chandra Deb.	Ditto	A 32	0·30	Ditto	...	6 6 6	6 6 6	87—0	82—4	3 0 0	0 4 0	1 9 7	...	4 12 11	

TABLE No. 2.

Object-lesson plots.

No. of plot.	Nature of demonstration.	Remarks.
1	2	3
1	Effect of tillage-ploughing.	
2	Do. of no tillage.	
3	Do. of frequent cultivation.	
4	Do. of not frequent cultivation.	
5	Do. of early sowing.	
6	Do. of late sowing.	
7	Method of broadcasting seeds.	
8	Do. of dibbling seeds.	
9	Do. of drilling seeds.	
10	Good *vs.* bad seeds.	
11	Effect of cattle manure.	
12	No manure or control plot.	
13	Effect of green manure.	
14	Do. of commercial fertilizers.	
15	Do. of irrigation.	
16	Do. of water-logging.	
17, 18, 19, 20	Cereals.	
21, 22, 23, 24	Pulses.	
25, 26, 27	Oil seeds.	
28	Fibres.	
29, 30	Crop mixtures.	
31	Plant individuality.	
32, 33	Rotational.	

(NOTE :—Three other plots will be added to show the " Effect of Shade " and " Crop-pest control ".)

TABLE No. 3.

Showing the laying-out works done on the Sabour Farm during 1915-16.

Serial No	Work done.	Object.	Amount paid to labourers.	Estimated cost of materials.	Total cost.	Remarks.
1	2	3	4	5	6	7
			Rs. a. p.	Rs. a. p.	Rs. a. p.	
1	Construction of a ring round the pucca well.	For the use of the well by farm hands.				
2	Extension of drinking trough for live-stock.	To allow more cattle to drink conveniently.				
3	Fixing of a pipe connecting well and trough.	To facilitate filling up of trough with water.	48 5 9	142 7 8	190 13 0	
4	Construction of a vat for putting up pump.	To put up a horizontal pump in position for work near the well.				
5	Construction of a drain east of the well.	To stop accumulation of water round the well.				
6	Construction of a drain east, and west of godown.	To stop accumulation of rain-water round godown.	17 4 6	47 0 0	64 4 6	
7	Construction of small pillars in godown.	To put up 'Machan' for seed storage.	3 14 0	3 0 0	6 14 0	
8	Construction of the flooring of hay shed.	To stop damage to stored *bhusa* by rats.	42 12 9	241 8 0	284 4 9	Rs. 20 more included for the bricks used for soling and concrete supplied from the farm.
9	Construction of "pucca" roads on the north, south and west of godown.	To keep, round godown clean and keep off rats from the same.	15 1 9	9 0 0	24 1 9	Rs. 9 ditto.
10	Levelling brick-kiln east of cattle shed.	For extension of the road north of implement shed to the eastern road.	179 3 9	...	179 3 9	
11	Deepening channel in northern section.	To store water for irrigation purposes.	29 6 0	...	29 6 0	
12	Fixing doors and windows in Eri house.	To make it serve as a godown.	6 5 0	...	6 5 0	
13	Thatching inside the roof of godown.	To reduce inside temperature.	16 3 9	28 2 9	44 6 6	
14	Extension of implement shed.	To accommodate engine and thrasher, etc.	...	2,000 0 0	2,000 0 0	Inclusive of labour and materials.
15	Construction of sluice-gate in nothern section.	To control water of College grounds and south channel.	...	1,217 0 0	1,217 0 0	Ditto.
16	Excavation of a tank	To fill up ditches, etc., in the old brick-kiln and reclaim the abandoned brick-field area.	1,979 11 9	...	1,979 11 9	
		Total ...	...	...	6,026 7 0	

Table No. 4.

Showing monthly distribution of labourers, bullocks, etc., during the year 1915-16.

Months.	Temporary monthly labourers.					Casual labour.			Skilled labour.			Total.	Number of days bullocks worked.	Pairs of bullocks engaged in—				Total.	Remarks.
	Ploughman.	Mate.	Watchman.	Cattle and Dairyman.	Smith boy.	Men.	Women.	Boys and Girls.	Blacksmith.	Carpenter.	Mason.			Cultivation.	Irrigation.	Transport.	Miscellaneous.		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
July 1915 ...	636	139	151	185	31	881	1,052	600	23	27	...	3,755	31	365	...	5	2	372	Bhadoi sowing, paddy transplanting maize hoeing, etc.
August ,, ...	622	145	153	185	26	401	581	493	15	21	...	2,042	27	121	...	15	...	136	Paddy transplanting Bhadoi harvest.
September ,, ...	632	146	121	179	30	739	793	247	25	21	3	2,876	28	250	...	20	2	272	Bhadoi harvest Silage making.
October ,, ...	690	155	123	186	29	836	720	451	16	14	...	3,229	29	661	2	6	3	672	Rabi sowing.
November ,, ...	627	138	116	177	30	480	599	395	25	22	...	2,609	30	341	23	5	14	383	Ditto.
December ,, ...	590	142	94	178	31	274	272	213	20	6	2	1,831	31	162	13	31	16	222	Paddy harvest.
January 1916 ...	564	144	92	186	27	441	262	379	43	20	26	2,184	31	80	49	65	17	211	Ditto.
February ,, ...	524	139	85	174	28	238	222	359	25	20	32	1,846	28	64	48	41	2	155	Sugarcane harvest and Gur making, tobacco curing, etc.
March ,, ...	515	143	100	177	27	196	131	366	27	61	2	1,754	30	10	28	88	3	129	Rabi harvest.
April ,, ...	520	150	118	171	30	534	328	520	27	22	32	2,452	31	229	17	54	3	303	Ditto.
May ,, ...	507	117	110	180	9	280	265	417	13	29	7	1,934	31	134	21	71	6	232	Hot weather cultivation.
June ,, ...	580	88	101	180	8	282	274	386	7	15	...	1,921	28	422	1	30	1	454	Bhadoi sowing.
Total ...	7,037	1,646	1,373	2,158	306	5,582	5,448	4,826	275	278	104	29,033	...	2,839	202	431	69	3,541	

Table No 5.

Showing distribution of rainfall at Sabour.

Months.	Rainfall during 1915-16.			Number of rainy days during 1915-16.			Heaviest in 24 hours.		Average for the last 8 years.	
	Fortnightly distribution.	Amount.	Total.	Fortnightly distribution.	Number of days.	Total.	Amount.	Date.	Rainfall.	Number of rainy days.
1	2	3	4	5	6	7	8	9	10	11
July 1915 ...	1st Fortnight ...	8·12	...	1st Fortnight ...	8	...	2·22	7th July 1915 ...	11·526	18·500
	2nd ,, ...	6·01	14·13	2nd ,, ...	9	17	...	.....	...	...
August ,, ...	1st ,, ...	4·70	...	1st ,, ...	8	...	1·45	14th August 1915	9·748	19·625
	2nd ,, ...	3·00	7·70	2nd ,, ...	10	18	...	.....	...	...
September ,, ...	1st ,, ...	3·37	...	1st ,, ...	3	...	3·96	20th September ,,	6·373	10·625
	2nd ,, ...	5·65	9·02	2nd ,, ...	5	8	...	.....	...	...
October ,, ...	1st ,, ...	0·64	...	1st ,, ...	2	...	0·40	8th October 1915	1·608	3·375
	2nd ,, ...	0·20	0·84	2nd ,, ...	1	3	...	.....	...	...
November ,, ...	1st ,, ...	0·00	...	1st ,, ...	...	...	1·79	20th November ,,	10·23	1·375
	2nd ,, ...	2·88	2·88	2nd ,, ...	2	2	...	.....	...	...
December ,, ...	1st ,, ...	0·00	...	1st ,, ...	...	...	...	.....	0·285	0·250
	2nd ,, ...	0·00	0·00	2nd ,, ...	...	...	...	.....	...	...
January 1916 ...	1st ,, ...	0·00	...	1st ,, ...	...	...	...	.....	0·178	0·375
	2nd ,, ...	0·00	0·00	2nd ,, ...	...	...	...	.....	...	...
February ,, ...	1st ,, ...	0·00	...	1st ,, ...	...	...	0·17	17th February 1916	0·860	2·125
	2nd ,, ...	0·17	0·17	2nd ,, ...	1	1	...	.....	...	...
March ,, ...	1st ,, ...	0·00	...	1st ,, ...	...	...	...	.....	0·650	2·125
	2nd ,, ...	0·00	0·00	2nd ,, ...	...	...	...	.....	...	...
April ,, ...	1st ,, ...	0·20	...	1st ,, ...	1	...	0·81	17th April ,,	0·887	2·125
	2nd ,, ...	1·23	1·23	2nd ,, ...	2	3	...	.....	...	...
May ,, ...	1st ,, ...	0·00	...	1st ,, ...	...	...	0·21	31st May 1916 ...	2·028	4·750
	2nd ,, ...	0·21	0·21	2nd ,, ...	1	1	...	.....	...	...
June ,, ...	1st ,, ...	5·01	...	1st ,, ...	8	...	2·30	23rd June 1916 ...	10·776	15·375
	2nd ,, ...	5·33	11·24	2nd ,, ...	8	16	...	.....	...	...

Table No. 6.

Composition of Soils of the Sabour Farm.

Serial No.	Ref. No. of Block.	Number of soil samples taken for analysis.	Essential soil constituents. Range in variation. From maximum. P_2O_5 per cent.	From maximum. K_2O per cent.	From maximum. N per cent.	To maximum. P_2O_5 per cent.	To maximum. K_2O per cent.	To maximum. N per cent.	Average per centage. P_2O_5 percent.	Average per centage. K_2O percent.	Average per centage. N percent.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12	13
1	A	16	·047	·023	·090	·026	·018	·050	·035	·020	·067	Note :— The phospheric acid and potash refer to their available state and the nitrogen to its organic form.
2	B	16	·037	·027	·070	·005	·014	·045	·017	·018	·057	
3	C	12	·014	·034	·065	·009	·023	·047	·011	·029	·057	
4	I	27	·039	·023	·081	·021	·006	·046	·028	·012	·059	
5	J	19	·019	·014	·058	·013	·008	·049	·016	·012	·055	
6	K	70	·013	·017	·095	·008	·007	·052	·011	·011	·070	
7	Orchard	3	·024	·010	·062	·016	·007	·040	·019	·009	·054	
8	L	54	·126	·061	·097	·026	·007	·069	·084	·029	·084	

TABLE No. 8.

Showing the Principal Crops grown on the Farm during 1915-16.

Serial No.	Common name of crop.	Scientific name of crop.	Acreage.	Object for which grown.	Seed rate per acre.	Remarks.
1	2	3	4	5	6	7
1	Maize (Jaunpur) ...	Zea Mays	3·0	Grain ...	12 lbs.	
2	„ (Local) ...	„ „	5·4	„ ...	10lbs.	
3	„ (Cock's prolific).	„ „	0·3	„ ...	20 lbs. ...	Seeds turned bad.
4	Maize (Local) ...	„ „	3·1	Fodder...	20 lbs.	
5	Maize + Rahar ...	Zea Mays + C. indicus ...	5·0	Grain ...	6 lbs.+6 lbs.	
6	Juar (Local) ...	Andropogon Sorghum ...	25·07	Fodder	20 lbs.	
7	Juar (Saran) ...	„ „ ...	0·3	Grain ...	10 lbs.	
8	Juar + Rahar ...	A. Sorgham + C. indicus ...	0·8	„ ...	5lbs. + 5lbs.	
9	Juar + Meth ...	A. Sorgham + Ph. aconitifolius.	0·16	Fodder	10lbs.+8lbs.	
10	Marua... ...	Eleusine Coracana ...	1·8	Grain ...	10 lbs. ...	Transplanted.
11	Sanhemp ...	Crotalaria juncea ...	8·80	Fibre ...	60 lbs.	
12	„ ...	„ „ ...	21·0	Green manuring.	40 lbs.	
13	Sanhemp + Rahar	C. juncea + C. indicus ...	1·3	Grain ...	5lbs.+5lbs.	
14	Rahar ...	Cajanus indicus ...	2·95	„ ...	12lbs.	
15	Dhaincha ...	Sesbania aculeata ...	15·80	Green manuring.	15 lbs.	
16	„ ...	„ „ ...	1·1	Grain ...	8lbs.	
17	Jute (Sirajganj) ...	Corchorus Capsularis ...	0·18	Fibre ...	8 lbs.	
18	„ (Deswal) ...	„ Olitorius ...	1·8	„ ...	10 lbs.	
19	Dhaincha + Cowpea	S. aculeata + V. catiang ...	2·0	Grain ...	4 lbs.+8 lbs.	
20	Meth ...	Phaseolus aconitifolius ...	7·5	Fodder	14 lbs.	
21	Paddy ...	Oryza Sativa	2·00	Seedling	800 lbs. ...	Seed bed.
22	Paddy, C. P. Aus ...	„ „	2·7	Grain ...	80lbs. broad cast, 40 lbs. transplanted.	
23	„ Benibhog ...	„ „ ...	0·4	„ ...	„	
24	„ Dahia ...	„ „	4·88	„ ...	„	
25	„ Kalamdan ...	„ „ ...	9·89	„ ...	„	
26	„ Hemcha ...	„ „	1·4	„ ...	„	
27	„ Kajerghore ...	„ „	10·82	„ ...	„	
28	„ Phillipine ...	„ „	0·9	„ ...	„	
29	Juar+Rahar + Sanhemp.	A. Sorghum + C. indicus + C. juncea.	3·3	„ ...	5 lbs.+5 lbs. +2½ lbs.	
30	Sugarcane ...	Saccharum Officinarum ...	3·14	Gur ...	1,800 lbs	
31	Groundnut ...	Arachis hypogoea ...	1·6	Fodder	40 lbs.	
32	Wheat, Pusa, 12 ...	Triticum Sativum ...	42·83	Grain ...	80 lbs.	
33	„ Pusa, Nos. 6, 7, 106, 110.	„ „ ...	2·30	„ ...	80 lbs.	

TABLE No. 8—*concld.*

Serial No.	Common name of crop.	Scientific name of crop.	Acreage.	Object for which grown.	Seed rate per acre.	Remarks.
1	2	3	4	5	6	7
34	Wheat (Local) ...	Triticum Sativum ...	0·70	Grain ...	80 lbs.	
35	Barley (Local) ...	Hordeum vulgare ...	2·5	„ ...	„	
36	Barley (Murley) ...	„ „ ...	1·0	„ ...	„	
37	Oat (Dumraon) ...	Avena Sativa	17·82	„ ...	„	
38	Gram (Local) ...	Cicer arietinum ...	1·4	„ ...	„	
39	Gram (Patna) ...	„ „	8·19	„ ...	„	
40	Gram (Kabuli) ...	„ „	0·5	„ ...	160 lbs.	
41	Pea (Patna) ...	Pisum Sativum ...	0·2	„ ...	80 lbs.	
42	Pea (Local) ...	„ „	0·3	„ ...	„	
43	Khesari ...	Lathytors Sativus ...	13·1	Grain and Fodder.	„	
44	Oat+Pea ...	A. Sativa + P. Sativum ...	3·30	Fodder	80 lbs.+40 lbs.	
45	Kulthi+Cowpea ...	D. biflorus + V. catiang ...	1·8	„ ...	16 lbs.+2 lbs.	
46	Gram+ Barley ...	C. arietinum + H. vulgare...	16·94	Grain ...	40 lbs.+40 lbs.	
47	Tobacco ...	Nicotina tabacum ...	4·3	Leaf ...	1 oz. ...	Transplanted.
48	Mustard ...	Brassica Napus ...	11·6	Grain ...	10 lbs. ...	'Maghigota' local early variety.
49	Carrot ...	Daucus carrota	0·6	Roots ...	12 lbs.	

TABLE No. 9.

Showing yield of Principal Crops of the Sabour Farm.

Serial No.	Name of crop.	Outturn in lbs. per acre.		Increase (+) Decrease(—)	Range in variation of average early outturn.		Remarks.
		Previsous year's Normal.	Last years.		Maximum.	Minimum.	
1	2	3	4	5	6	7	8
		lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	
1	Barley (Local)	931 12	775 10	— 156 2	1,358 0	592 10	For 5 years.
2	,, (Murley)	598 6	517 4	—81 2	873 0	404 12	,, 3 ,,
3	Carrot (for fodder)	20,071 5	29,072 0	+9,000 11	29,072 0	11,070 10	,, 2 ,,
4	Dhaincha (for seed	496 8	487 10	—8 14	534 0	467 13	,, 3 ,,
5	Gram (Kabuli)	437 0	586 0	+149 0	586 0	160 0	,, 3 ,,
6	,, (Local)	569 6	246 8	—322 14	892 4	246 8	,, 2 ,,
7	,, (Patna)	674 6	415 4	—259 2	1,012 4	398 2	,, 5 ,,
8	Jute (Deswal)	324 4	384 0	+59 12	384 0	264 8	,, 2 ,,
9	Juar for seed (Local)	269 6	338 12	+69 6	338 12	200 0	,, 2 ,,
10	,, for fodder	13,867 2	25,741 0	+11,873 14	25,741 0	6,432 4	,, 4 ,,
11	Maize (Jaunpur)	460 8	1,024 12	+564 4	1,024 12	98 2	,, 4 ,,
12	,, (Local)	472 4	625 8	+153 4	625 8	319 0	,, 2 ,,
13	Marua	428 6	521 4	+92 14	521 4	335 8	,, 2 ,,
14	Mustard (Maghi)	582 6	428 2	—154 4	1,431 6	266 6	,, 5 ,,
15	Oat (Dumraon)	709 6	709 4	—0 2	1,028 0	396 10	,, 5 ,,
16	Paddy, Aus	600 10	817 4	+216 10	943 14	243 0	,, 5 ,,
17	,, Aman...	1,113 14	877 10	—238 4	1,621 12	780 0	,, 5 ,, including all varieties grown at Sabour.
18	,, Hemcha	765 7	687 4	—78 3	843 10	687 4	For 2 years.
19	,, Kalamdan	939 13	933 12	—6 1	945 14	933 12	,, 2 ,,
20	,, Kajerghore	742 8	851 10	+109 2	851 10	683 6	,, 2 ,,
21	,, Katki...	1,373 0	1,238 12	—134 4	2,058 0	887 12	,, 5 ,,
22	Pea (Patna)...	820 2	962 8	+142 6	1,314 2	238 10	,, 5 ,,
23	Rahar (Aghani)	444 4	198 8	—245 12	690 0	198 8	,, 2 ,,
24	,, (Deshi)	601 2	598 4	—2 14	726 4	434 0	,, 5 ,,
25	,, (Saran)	773 8	900 0	+126 8	1,042 12	534 0	,, 4 ,,
26	Sanhemp fibre	465 4	599 4	+134 0	803 4	180 2	,, 5 ,,
27	,, Seed	243 15	153 6	—90 9	332 8	153 6	,, 2 ,,
28	Sugarcane (Gur)	2,319 2	2,963 12	+644 10	3,067 0	1,175 10	,, 5 ,,
29	Tobacco (Bhemgi)	1,212 14	160 0	—1,052 14	1,867 14	160 0	,, 3 ,,
30	,, (Local)	994 14	233 10	—761 4	1,720 14	233 10	,, 3 ,,
31	,, (Local Bilaty)	457 13	188 10	—269 3	727 0	188 10	,, 2 ,,
32	,, (Little Flemings) ...	1,015 12	261 2	—754 10	2,096 10	261 2	,, 3 ,,
33	,, (Pusa-28)	993 7	208 10	—784 13	1,778 4	208 10	,, 2 ,,
34	,, (Sumatra) ...	1,085 12	458 10	—627 2	3,030 0	458 10	,, 3 ,,
35	,, (White Barley) ...	944 14	440 6	—504 8	1,658 6	440 6	,, 3 ,,
36	Wheat (Local)	615 12	575 6	—40 6	940 0	101 4	,, 5 ,,
37	,, (Pusa, 6)	589 3	404 12	—184 7	1,373 6	79 4	,, 4 ,,
38	,, (Pusa, 7)	1,136 12	582 2	—554 10	1,814 0	130 8	,, 5 ,,
39	,, (Pusa, 8)	824 0	926 4	+102 4	1,176 12	89 10	,, 5 ,,
40	,, (Pusa, 12)	1,165 10	743 8	—422 2	2,312 0	360 10	,, 5 ,,
41	,, (Pusa, 106)	597 0	632 10	+35 10	891 0	60 6	,, 5 ,,
42	,, (Pusa, 110)	349 10	190 10	—159 0	508 10	190 10	,, 2 ,,

Table No. 10.

Experiment Statement.

Serial No.	Reference No.	Nature of Experiment.	Acreage.	Crop experimented upon		Year of experiment.	Object of experiment.
				Bhadoi.	Rabi.		
1	2	3	4	5	6	7	8
1	AE/1	Soil fertility trial	7·2	.....	Wheat—Pusa, 12	Second ...	To find out the degrees of uniformity in fertility conditions of the several plots before the starting of any experiment thereon.
2	AE/2	Liming	1·8	Marua ...	Oat	Second ...	To determine the effect of two kinds of lime (quick and slaked) when applied every year, alternate year, and every three years to Marua and oat on upland soil.
3	AE/3	Date of sowing	1·2	Rahar ...	Rahar ...	Second ...	To ascertain the proper time of sowing Rahar—both Saran and Local varieties. It is observed on many occasions that early sowing is generally accompanied with too much vegetative growth, probably at the expense of fruiting capacity.
4	BE/1	Rotation or cropping	7·2	a. Maize ... b. Maize ... c. Jute ...	Wheat ... Mustard. Tobacco.	First ...	To find out the best rotation for rich homestead land.
5	BE/2	Date of planting (Mr. Taylor's Expt.)	0·8	Sugarcane ...	Sugarcane ...	Third ...	To determine the relationship between date of planting, date of ripening and the changes that undergo in the sucrose content, etc.
6	CE/1	Fertilizer (Mr. Taylor's Expt.) ...	11·0	Juar for fodder ...	Wheat ...	Fourth ...	To test the effect of different commercial fertilizers like Pot. Sulphate, Am. Sulphate, Super phosphate Basic slag and green manuring on wheat on upland soils.
7	CE/2	Hot weather cultivation	2·2	.....	Wheat ...	Second ...	To determine the effect of hot-weather and monsoon cultivation in conjunction with deep and shallow ploughing and application of cattle manure on wheat.
8	DE/1	Variety trial and date of transplantation.	2·5	.....	Tobacco ...	Second ...	To find out the best time of transplanting the seven varieties of tobacco under trial, viz., Desi, Bilati, Pusa 28, Little Flemingo, Sumatra, Bhengi, White Barley.
9	EE/1	Variety trial	0·5	.....	Wheat ...	Fourth ...	To preserve the purity of the different varieties of Pusa wheats, viz., 6, 7, 8, 12, 106, 110, and compare them with the local wheat.
10	IE/1	Green-manuring and liming ...	5·0	.....	Mustard ...	Second ..	To test the effect of green-manuring in conjunction with lime on mustard.
11	IE/2	Soil fertility trial	12	.....	Wheat ...	Second ..	To ascertain the difference in fertility conditions of the different plots before starting a rotation experiment on them.
12	JE/1	Rock phosphate experiment ...	3·0	Maize ...	Mustard ...	Second ...	To test the effect of Moll's Flour Phosphate in conjunction with lime and when applied in different times of the year. *N.B.*—This year the residual effect of last year's application may be studied as the material is no longer available.
13	JE/2	Variety trial	2·0	Rahar ...	Rahar ...	Second ...	To compare the yields of different kinds of Rahar.
14	JE/3	Crop mixture	2·0	Sanhemp and Rahar.	Sanhemp and Rahar.	Second ...	To find out the best method of seed production in Sanhemp.
15	KE/1	Method of planting	1·3 0·4 0·8	Paddy:—Aus, C. P. Benibhog Kajerghore.	.....	First ...	To compare transplantation with dibbling or drilling and broad-casting.
16	KE/2	Seedling experiment	3·2	Paddy—Kalamdan	.....	Second ...	To find out the best number of seedlings to transplant per hole when the date of transplantation is taken into account.
17	KE/3	Green-manuring with Dhaincha ...	1·0	Paddy—Kajerghore	.....	Fourth ..	To ascertain in which year a green-manured plot gives the best result and for how many years a plot is to be green-manured before and appreciable result is obtained.
18	KE/4	Fertilizer with Bone-meal and saltpetre.	0·8	Paddy—Kajerghore	.....	Third ..	To test the beneficial effects of bone-meal and saltpetre on paddy.
19	KE/5	Green-manuring with Sanhemp .	1·1	Paddy—Dahia ...	.....	Second ...	Same as KE/3.
20	LE/1	Green-manuring	0·95	Paddy Dahia ...	.....	Second ...	To ascertain the effects of continuous and alternate green-manuring on paddy in conjunction with lime and bone-meal.
21	LE/2	Seedling experiment	4·6	Paddy—Kalamdan	.....	Third ..	To ascertain the best number of seedlings to transplant per hole when the following factors are taken into account, viz., date of transplantation, age of seedlings, strength of seedlings, fertility of land, water requirements, and spacing allowed to the seedlings.
22	LE/3	Observational...	0·9	Paddy—Kalamdan	.....	Second ...	The following are the lines of observation—Economic limit of seedlings per hole (1 to 40). Longevity of uprooted paddy seedlings. Pruning of paddy seedlings—Paddy cutting, Root stem; Transplantation of tilerings.
23	LE/4	Wheat adaptability	0·9	.....	Wheat ...	Second ...	To ascertain the suitability of Pusa, 12 and 110, for low char lands.

TABLE No. 11-A.

Showing the number of Cattle distributed from the Sabour Dairy Farm to District Boards and others during the year ending the 30th June 1916.

Serial No.	Name of cattle.	Brand number.	Price.	To whom supplied.	Remarks.
1	2	3	4	5	6
			Rs.		
1	Barbati (cow) ...	P. 72	50	Babu S. C. Roy, Pleader, Bhagalpur.	
2	Gauharjan (cow with calf)	P. 65	70	Dr. Kalipada Chakravarti, Bhagalpur.	
3	Kharaiti (Ditto)	P. 62	70	Babu Raghunath Lal of Bhagalpur.	
4	Ganesh (bull) ...	S. 31	100	Deputy Commissioner of Angul.	
5	Radha (heifer) ...	S. 34			
6	Kausalya do. ...	S. 30			
7	Lokna do. ...	S. 38	230	Deputy Commissioner of Palamau.	
8	Sugiah do. ...	S. 42			
9	Chouri do. ...	S. 41			
10	Dhalu (bull) ...	S. 21	125	Manager, Sonbarsa Raj.	

TABLE No. 11-B.

Showing the quantity of Seeds, etc., indented, and the quantity supplied during the year 1915-16.

Serial No.	Name of seeds.	Quantity indented.	Quantity supplied.	Remarks.
1	2	3	4	5
		lbs. oz.	lbs. oz.	
1	Barley (Local)	3,373 15	2,376 5	
2	„ (Murley)	56 0	56 0	
3	Cane cuttings (Khari) ...	500 cuttings.	500 cuttings.	
4	Dhaincha	695 4	250 15	
5	Gram (Kabuli)	102 7	7 9	
6	„ (Patna)	2,161 14	1,147 12	
7	Groundnut	113 2	....	
8	Grass seed (lawn)	6 2	...	
9	Khesari (Local)	4 1	4 1	
10	Linseed (Local)	39 1	...	
11	Lucerne seed	6 2	...	
12	Maize (Jaunpur)	302 4	302 4	
13	„ (Local)	78 10	78 10	
14	„ (American)	1 8	1 8	
15	Marua	6 2	6 2	
16	„ seedlings	1,664 sq.ft.	1,664 sq.ft.	

Serial No.	Name of seeds.	Quantity indented.		Quantity supplied.		Remarks.
1	2	3		4		5
		lbs.	oz.	lbs.	oz.	
17	Mustard (Maghi)	60	15	60	15	
18	„ (Raipur)	61	11	...		
19	Meth (Local)	246	13	246	13	Seeds supplied purchased from outside.
20	Mung (Sona)	22	10	...		
21	Oat (Dumraon)	19	8	168	10	
22	Paddy (Benibhog)	4	1	4	1	
23	„ (Badshabhog) ...	164	9	...		
24	„ (C. P. Aus paddy) ...	790	14	626	5	
25	„ (Dahia)	863	8	863	8	
26	„ (Dadkhani)	596	8	...		
27	„ (Debtasar)	20	9	...		
28	„ (Hemcha)	20	9	...		
29	„ (Kalamdan)	56	0	56	0	
30	„ (seedling)	3,500 sq. ft.		3,500 sq.ft.		
31	Pea (Patna)	174	13	...		
32	Potato (Deshi) ...	329	2	...		
33	„ (Italian)	82	4	...		
34	„ (Naini Tal)	287	15	...		
35	Papaya (Ceylon)	200 seeds.		...		
36	Rahar (Saran)	186	2	186	2	
37	„ (Aghani)	45	4	4	1	
38	Soybean (Napali)	30	13	...		
39	Safflower seed (Local) ...	82	4	82	4	Supplied from outside purchase.
40	Sanhemp seed ...	104	14	102	13	
41	Tobacco (seed) ...	0	8	0	8	
42	„ local Bilaty ...	0	2	...		
43	Wheat (Local)	4,003	15	2,492	8	Ditto.
44	„ Pusa, No. 6 ...	14	6	14	6	
45	„ „ „ 7 ...	96	10	96	10	
46	„ „ „ 8 ...	66	5	66	5	
47	„ „ „ 12 ...	9,801	9	9,801	9	
48	„ „ „ 106 ...	14	6	14	6	
49	„ „ „ 110 ...	1,073	12	5	2	
50	„ Pusa Wheat ...	483	6	...		
51	„ (Buxar)	61	11	...		
52	„ (Muzaffarnagar) ...	82	4	...		
	Manure.					
1	Bone-meal	82	4	...		
	Implements.					
1	Meston Plough	Six.		Six.		

TABLE No. 12.

Composition of important Feeding Stuffs used on the Farm.

Constituents.	Feeding Stuffs.									Remarks.
	Juar Silage.	Paddy Straw.	Mixed Bhusa.	Rahar Bhusa.	Rice-meal.	Gram.	Pea.	Oat.	Mustard-Cake.	
1	2	3	4	5	6	7	8	9	10	11
	%	%	%	%	%	%	%	%	%	
Moisture	68·01	10·77	7·45	6·88	7·28	7·07	7·30	11·94	13·58	
Ether extract	...	...	...	...	17·46	3·83	0·87	5·40	11·99	
† Albuminoids	0·98	1·83	3·93	10·25	12·17	20·94	24·18	8·17	33·37	The ash of rice-meal contains, besides sand P^2O^5—4·01% and K^2O—1·13.
Crude fibre	8·19	36·80	27·52	27·30	11·32	9·70	5·47	10·56	3·63	
Ash	3·32	17·07	16·32	8·70	14·38 ††	3·36	3·11	4·53 ††	9·98 ††	
Carbohydrates (by difference)	19·20	33·53	44·78	46·87	37·39	55·10	59·07	71·24	41·03	
† Containing N	0·157	0·293	0·629	1·640	1·950	3·350	3·868	1·310	5·330	
†† Containing sand ...	...	...	...	..	7·28	...	...	2·65	3·06	

TABLE No. 13.

Showing the results of comparative trials of Sugarcane Mills.

Particulars.	"Beheea" Mill—3-rollered.		"Hathi" Mill.		Remarks.
	1st test.	2nd test.	1st test.	2nd test.	
1	2	3	4	5	6
	Hrs. min.	Hrs. min.	Hrs. min.	Hrs. min.	Variety of cane—
No. of hours the mill worked ...	5 35	4 35	5 35	4 35	*Khari.*
	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	Average percentage of juice extracted.
Weight of Cane crushed ...	874 4	791 15	935 15	839 4	Beheea—58%.
Average weight of Cane crushed per hour.	151 1	172 12	167 8	183 1	Hathi—64·31%.
Weight of juice obtained ...	475 2	477 2	611 6	538 0	Difference in favour of "Hathi"=6·30.
Percentage of juice extracted ...	56%	60%	65%	63·61%	
Weight of *gur* obtained ...	85 5	77 9	100 4	87 15	

No. 1290-D., dated Bankipore, the 11th August 1916.

From—G. C. SHERRARD, Esq., B.A., Deputy Director of Agriculture, Patna Division,

To—The Director of Agriculture, Bihar and Orissa.

I have the honour to submit herewith the Annual Report of the Bankipore Farm for the year ending 30th June 1916.

Annual Report of the Bankipore Agricultural Station for the year 1915-16.

The Bankipore Agricultural Experimental Station was established in 1906. The farm is situated in latitude 25° 37″ north and longitude 85° 14″ east on land just south of the Bankipore Railway Station of the East Indian Railway and comprises about 210 acres. of which about 180 acres are under cultivation, almost the whole being rice land; the remainder is occupied by roads, buildings, orchard, etc.

The soil is a heavy, almost black, clay. The following table gives the chemical analysis of the soil made by Mr. Taylor, the Agricultural Chemist to the Government of Bihar and Orissa:—

Particulars.	North of Distributary.		South of Distributary.	
	Surface soil, per cent.	Sub-soil, per cent.	Surface soil, per cent.	Sub-soil, per cent.
1	2	3	4	5
Insoluble matter	76·96	73·84	75·60	73·85
Potash	·82	·82	·80	·83
Soda	·82	·82	·50	·52
Lime	1·89	1·65	·82	1·32
Magnesia	1·38	1·96	·73	1·17
Iron Aluminium	14·43	17·06	17·24	18·32
Phosphorus Pentoxide ...	·25	·30	·17	·13
Sulphur Trioxide	Trace	Trace	Trace	Trace
Carbon Dioxide	Trace	Trace	Trace	Trace
Combined moisture and organic matter.*	3·42	3·55	4·23	3·36
Total ...	100·00	100·00	100·09	100·00
* Containing nitrogen ...	·07 per cent.	·055 per cent.	·065 per cent.	·043 per cent.

The farm is irrigated by the Patna Distributary of the Khagole Branch of the Sone Canals.

The total cost of the farm for the financial year from April 1st, 1915, to March 31st, 1916, was Rs. 13,533-13, the amount paid into the Treasury during the year was Rs. 6,852-14-8.

Certain deductions may be made from this total in order to arrive at the approximate cost of the cultivation and upkeep of the station. These are detailed below, no account being taken of various miscellaneous items not actually spent on farm upkeep :—

	Rs.	a.	p.	Rs.	a.	p.
Total cost of the experiment station for the year 1915-16 ...				13,533	13	0
Deduct—						
(1) Pay and travelling allowance of the Superintendent, Overseers and office	2,882	7	8			
(2) Postage and telegraph charges, freight, office expenses, etc.	56	11	3			
(3) Culverts, irrigation channels, bunds, etc. ...	1,078	7	0			
				4,017	9	11
Total ...				9,516	3	1
				Rs.	a.	p.
Total paid into the Treasury during the year 1915-16 ...				6,852	14	8
Deduct—						
Stock in hand on April 1st, 1915	2,604	7	6			
Bills due on April 1st, 1915	839	13	6			
Total ...	3,444	5	0			
Add—						
Stock in hand on March 31st, 1916	1,319	14	9			
Bills due on March 31st, 1916	241	0	0			
Total ...	1,560	14	9	1,883	6	3
Total ...				4,969	8	5

The deductions made from the total cost of the farm under the heading No. 3 have been inserted because, as explained in last year's report, while they are a necessity, they are not a fair charge on the running expenses of the farm. During the year a sum of Rs. 1,343-3 was spent on the purchase of bullocks. Owing to the situation of the farm the cost of labour is particularly high.

If the above calculations are allowed, a loss is shown of Rs. 4,546-10-8. This is much more than it ought to be and is greater than that of last year.

Character of the Season.

The following table gives the number of days on which rain fell, and the total rainfall in inches, for each month during the year, together with the average for eight years :—

Month.	1915-16.		Average for eight years.
	Number of rainy days.	Rainfall, in inches.	Rainfall, in inches.
1915.			
April	Nil	0·20	0·34
May	2	1·48	1·12
June	8	8·08	8·77
July	16	9·20	8·34

Month.	1915-16.		Average for eight years.
	Number of rainy days.	Rainfall, in inches.	Rainfall, in inches.
1915.			
August	21	16·08	14·14
September	8	9·39	8·59
October	6	1·78	2·09
November	1	1·38	0·69
December	Nil	0·20	0·16
1916.			
January	2	0·08	0·25
February	3	0·78	0·66
March	1	0·76	0·57
Total ...	68	49·41	45·72

The year on the whole was favourable to the rice crop, but the rain in November came at a time when it did damage to a good deal of the *rabi* crops on heavy low-lying land, such as this farm comprises.

Experimental Work on the Farm.

From July the 1st, 1915, to January the 29th, 1916, the farm was in the immediate charge of the Superintendent, Babu Khiti Bhushan Mukharji, who was then degraded for misconduct. From January the 30th to March the 15th, and from March the 28th to May the 31st, Babu Hari Das Gupta, and from the 16th to the 27th of March, Saiyid Muzahar Imam, were in charge. On June the 1st, 1916, Maulvi Muhammadi Khan was appointed Superintendent, and had charge of the farm during the remainder of the year.

The experimental results given in this report are taken from the Superintendent's returns.

Rice.—*Oryza sativa.*

Nearly the whole farm is rice land. Work on this crop is of importance as a larger area is under rice than under any other crop, both in the district and in the province as a whole.

I.—Manurial experiments.

Series A.

Manure applied, per acre.	Outturn per acre, in pounds.		Profit (+) or loss (−), in rupees per acre.
	Grain.	Straw.	
			Rs. a.
300 lbs. of basic slag	1,444	2,224	+8 8
1,640 lbs. of lime	1,664	2,709	−28 14
1,640 lbs. of lime + 4,100 lbs. of cowdung ...	1,753	2,875	−33 5
Unmanured	1,494	2,291	+26 4

The experiments were carried out in duplicate on $1\frac{1}{5}$th acre plots, the above figures being the average of the two plots. The variety grown was *Kalamdan*, a local medium paddy.

Series B.

Manure applied per acre.	Outturn per acre, in pounds.		Profit, in rupees per acre.
	Grain.	Straw.	
			Rs a. p.
8,200 lbs. of cowdung	1,730	2,850	19 2 0
4,100 „ „	1,582	2,432	16 14 0
410 „ of castor cake	1,570	2,542	8 11 0
Green manure—dhaincha (*Sesbania aculeata*) ...	1,550	2,306	23 2 0
„ „ sanai (*Crotolaria juncea*) ...	1,464	2,190	16 15 0
164 lbs. of sulphate of magnesia ...	1,630	2,551	8 14 0
164 „ khari salt (Hide salt)	1,673	2,543	26 8 0
Unmanured	1,391	2,158	20 14 0

The experiments were carried out in duplicate on $\frac{1}{5}$th acre plots, the above figures being the average of the two plots. The variety transplanted was *Kalamdan*, a local medium rice.

This year's results are unusual, in that the application of 8,200 lbs. of farm yard manure has given a higher yield, and proved more profitable than a dressing of half that amount.

The increase due to ploughing in a green manure is less than usual and has not been enough to pay for itself in the case of the sanai. A reference to the reports of previous years and other departmental publications, will show that this is an unusual result, and the explanation is that the green manure was sown on an early local shower that did not supply sufficient moisture to carry the crop through the break that followed—the result being a very patchy thin covering, giving very little manure.

Khari salt has again given the good results expected from it on this type of soil.

Series C.

Manure applied, per acre.	Outturn per acre in pounds.		Profit, in rupees per acre.
	Grain.	Straw.	
			Rs. a. p.
160 lbs. of ammonium sulphate	1,648	2,783	17 8 0
120 „ of superphosphate	1,585	2,808	31 0 0
100 „ of muriate of potash	1,374	2,019	13 1 0
100 „ of ammonium sulphate + 100 lbs. of muriate of potash.	1,876	3,024	12 11 0
160 „ of ammonium sulphate + 120 lbs. of super phosphate.	1,886	3,372	23 2 0
120 „ of superphosphate + 100 lbs. of muriate of potash.	1,420	2,422	10 11 0
Unmanured	1,028	1,545	12 5 0

The experiments were carried out in duplicate on $\frac{1}{5}$th acre plots, the above figures being the average of the two plots, except in the case of muriate of potash, where, as one plot was badly diseased, the duplicate only has been included. The variety was *Baitarni*, a local coarse paddy.

The series is interesting, and clearly shows that both ammonia and phosphate give considerable benefit to the crop on this soil; the results with potash, however, are by no means so definite, for, while it would appear from the plots manured with super-phosphate, that the soil is not deficient in potash, yet in the plots manured with muriate of potash and ammonium sulphate, it would appear that the addition of potash has had a marked beneficial effect. It is worthy of note that, with the single exception of the muriate plot mentioned above, which was diseased, both series gave similar results. Further experiments on this point will be carried out.

My thanks are due to the Agricultural Chemist, who kindly examined the results of the above manurial experiments with me, and has made suggestions from time to time.

It is the practice, in most parts of Bihar, to broadcast a *rabi* crop in the standing rice, no furtrer cultivation being necessary, this crop known as *Paira* is left to grow after the rice is harvested. In the above manurial plots gram (*Cicer arietinum*) was sown in this way, and the results recorded. Very little reliance, however, can be put on the results, at least until the experiments have been carried out for a number of years, as there are many other factors which influence the growth of the gram besides the manure applied to the rice. For example, small inequalities in the surface made at the time of puddling the rice plot will cause the water to stand longer in certain parts of the plot, and render the germination of the gram uneven, and these must vary from plot to plot and from year to year.

The following table gives the outturn and profit of this gram—*Cicer arietinum*, together with the profit on the two crops, the average of the duplicate experiments being taken:—

Manure applied, per acre.	Outturn per acre, in pounds.		Profit, in rupees per acre.	Profit (+) and loss (—) on the two crops, in rupees per acre.
	Grain.	Straw.		
1	2	3	4	5
			Rs. a. p.	Rs. a. p.
300 lbs. of basic slag	497	400	16 7 0	+24 15 0
1,640 lbs. of lime	536	570	20 13 0	— 8 1 0
1,640 lbs. of lime + 4,100 lbs. of cowdung ...	402	343	13 7 0	—19 14 0
Unmanured	717	609	27 6 0	+ 3 10 0
8,200 lbs. of cowdung...	718	505	29 0 0	+18 2 0
4,100 lbs. „	684	612	25 6 0	+42 4 0
410 lbs. of castor-cake	475	382	15 9 0	+24 4 0
Green manure — *dhaincha*	686	614	26 11 0	+49 13 0
„ *sanai*	520	381	17 4 0	+34 3 0
164 lbs. of sulphate of magnesia	370	320	10 12 0	+19 10 0
164 lbs. of khari salt	433	379	14 0 0	+40 8 0
Unmanured	638	537	23 11 0	+44 9 0
160 lbs. of ammonium sulphate	331	276	8 14 0	+26 6 0
120 lbs. of super-phosphate	433	322	12 11 0	+43 11 0
100 lbs. of muriate of potash	484	350	15 6 0	+28 7 0
160 lbs. of ammonium sulphate + 100 lbs. of muriate of potash.	633	491	22 5 0	+35 0 0
160 lbs. of ammonium sulphate + 120 lbs. of super-phosphate.	402	308	11 4 0	+34 6 0
120 lbs. of super-phosphate + 100 lbs. of muriate of potash.	482	360	15 4 0	+25 15 0
Unmanured	413	336	12 3 0	+24 8 0

Experiments carried out on all the farms when they were in my charge, showed that 4,100 lbs. of cowdung usually gave as large an increase of grain and straw as did one of twice that amount; and as the value of the manure and the cost of carting and spreading were greater in the former case, the smaller dressing was the more profitable, but I was unable for various reasons to examine the residual effect of the two manures. This year, however, details are available, and are shown in the following table :—

Manure applied, per acre.	1914-15.			1915-16.		
	Outturn per acre, in pounds.		Profit, in rupees per acre.	Outturn per acre, in pounds.		Profit, in rupees per acre.
	Grain.	Straw.		Grain.	Straw.	
1	2	3	4	5	6	7
			Rs. a. p.			Rs. a. p.
4,100 lbs. of cowdung ...	1,645	3,870	45 6 0	1,524	2,580	35 12 0
8,200 lbs. „ ...	1,640	4,420	41 10 0	1,735	3,120	45 1 0
4,100 lbs. „ ...	1,663	4,660	52 8 0	1,685	2,840	41 13 0
8,200 lbs. „ ...	1,678	5,000	48 12 0	1,740	3,030	44 11 0

That is to say, the profit at the end of the two years is, after supplying 4,100 lbs of cowdung, Rs. 81-2-0 and Rs. 94-5-0, or an average of Rs. 87-12-0 per acre; after supplying 8,200 lbs. of cowdung, Rs. 86-11-0 and Rs. 93-7-0 or an average of Rs. 90-1-0.

While, for reasons given above, too much reliance should not be placed on the outturn of the *Paira* crop, the details of the gram grown on the same plots are given below :—

Manure applied per acre.	1914-15.			1915-16.			Profit on the two crops for two years, in rupees per acre.
	Outturn per acre, in pounds.		Profit, in rupees per acre.	Outturn per acre, in pounds.		Profit, in rupees per acre.	
	Grain.	Straw.		Grain.	Straw.		
1	2	3	4	5	6	7	8
			Rs. a. p.			Rs. a. p.	Rs. a. p.
4,100 lbs. of cowdung ...	870	903	45 10 0	505	360	16 10 0	142 6 0
8,200 lbs. „ ...	920	995	49 10 0	825	555	31 14 0	168 3 0
4,100 lbs. „ ...	1,023	1,270	55 11 0	775	560	30 2 0	180 2 0
8,200 lbs. „ ...	1,108	1,365	63 11 0	930	550	36 2 0	193 4 0

From the above figures it appears that, while a dressing of 4,100 lbs. of cowdung per acre is more profitable on a rice crop in the first year than one of twice that amount, the latter pays better in the end.

II.—Variety Experiments.

Variety.	Outturn per acre, in pounds.	
	Grain.	Straw.
1	2	3
Baitarni	1,646	2,715
Kalamdan	1,463	2,296
Kartika	1,433	1,895
Dadkhani	1,082	1,876
Badshahbhog	1,172	1,929
Samudrabali	1,322	2,382
Srikoli	933	1,447

All the above are *aghani*, except *kartika* which is cut in October or November *Baitarni*, is a fairly coarse, *Kalamdan* a medium and *Srikoli* a fairly fine local rice; *Dadkhani*, *Badshahbhog* and *Samudrabali* are very fine Bengal rice.

III.—Seedling Experiments.

Series A.

Method of transplanting.	Outturn per acre, in pounds.	
	Grain.	Straw.
1	2	3
1 seedling per hole	401	960
2 seedlings „	365	854
4 „ „	407	885
8 „ „	574	1,167

The experiments were carried out in triplicate, in two series, the plots were $\frac{1}{5}$th of an acre, and in the third they were $\frac{1}{10}$th of an acre. The above figures are the average of the three plots. The variety was *Kalamdan*, and the seedlings were transplanted on relatively high land, which is not irrigated.

Series B.

This series was arranged to test the relative merits of sowing less seed in the seed bed, and transplanting less seedlings in the field, compared with the practice of the local cultivators. Arrangements were made with a cultivator near the farm to supply some of his own seedlings for comparison with the farm seedlings, and the same day on which he sowed his seed bed at the rate of 615 lbs. of seed per acre, a farm seed bed was sown at the rate 410 lbs. per acre. The seedlings from each were uprooted and transplanted

on the same day, in the middle of August. The following table gives the results :—

Method of transplanting.	Outturn per acre, in pounds.			
	410 lbs. of seed per acre of seed bed.		615 lbs. of seed per acre of seed bed.	
	Grain.	Straw.	Grain.	Straw.
2 seedlings per hole	730	1,144	418	1,040
4 „ „	947	1,296	474	1,128
8 „ „	985	1,292	732	1,152

The experiments were carried out on $\frac{1}{4}$ acre plots, the variety transplanted was *Baitarni*. It is unfortunate that, owing to want of space, the series could not be duplicated, as the result is more strongly in favour of the lower seed rate than one would expect.

IV.—Cultivation Experiments.

It is the general practice in this district to broadcast a *rabi* crop in the fields before harvest, this being cut in March. Usually by that time the clay soil is too hard to plough and nothing is done to it until the next rainy season. That is, as a rule, such land is stirred and puddled under water once a year, and otherwise left uncultivated. A common practice is generally a good one, but experiments are being carried out on this farm to find out whether hot-weather cultivation has any effect on the rice and *paira* crop. This year there were showers at the end of February, and it was possible to plough the land early in March after harvest. One-third of the area selected was ploughed with the Punjab plough, one-third with the *desi* plough, and one-third left unploughed. The land 2·4 acres was divided into sets of three plots, so that the experiment was quadrupled, but each lot was harvested together, and the following table gives the results reduced to pounds per acre. The variety transplanted was *Baitarni* :—

Treatment of the land.	Outturn per acre, in pounds.		Profit in rupees, per acre.
	Grain.	Straw.	
			Rs. a. p.
Ploughed with the Punjab plough	1,322	1,985	20 8 0
Ploughed with the *desi* plough	1,159	1,833	14 13 0
Unploughed	961	1,568	10 11 0

The following table gives the outturn of the following *rabi* crop, gram, on the same plots. But the danger of attaching too much importance to variations in this crop, as pointed out above, must not be lost sight of :—

Treatment of the land before the rice crop.	Outturn per acre, in pounds.		Profit in rupees, per acre.	Profit on the two crops in rupees, per acre.
	Grain.	Straw.		
			Rs. a. p.	Rs. a. p.
Ploughed with the Punjab plough ...	747	538	28 3 0	48 11 0
Ploughed with the *desi* plough ...	677	506	25 5 0	40 2 0
Unploughed	619	426	21 11 0	32 6 0

SUGARCANE—*Saccharum officinarum.*

I.—Variety experiments.

Two varieties were grown, *Hemja* and *Chinia*, each on ·97 of an acre, half the land being trenched and half cultivated in the local way. The following table gives the outturn, reduced to pounds per acre :—

Variety.	Outturn per acre, in pounds.	
	Cane.	Juice.
Hemja	39,876	22,430
Chinia	39,609	24,212

II.—Cultivation experiments.

Each variety was grown in four plots, two of which were trenched, two cultivated in the local way. The outturn, giving the average of the two plots in pounds per acre, was as follows :—

Variety.	Outturn per acre, in pounds.			
	Trenched.		Local method.	
	Cane.	Juice.	Cane.	Juice.
Hemja	34,535	19,446	45,215	25,413
Chinia	37,318	22,825	41,897	25,599

In addition to the above a trial was made of various methods of making *gur*, in order to see which paid best : the results are being published elsewhere.

MISCELLANEOUS.

A heavy shower in November did a certain amount of damage to the *rab* crops on low-lying areas, both on the farm and in the neighbourhood, and some land of this type had to be resown. One of the lowest barrow-pits, alongside one of the farm roads, could not be sown until the 26th and 27th of December. This was considerably later than the people outside the farm continued sowing, but gram sown on this date, though late, and a poor crop, yet gave a profit of Rs. 1-14-0 an acre. The details were—seed sown 42 lbs., outturn, grain 262 lbs., straw 240 lbs.

G. SHERRARD,

Deputy Director of Agriculture.

No. 1257-D., dated Bankipore, the 5th August 1916.

From—G. C. SHERRARD, Esq., B.A., Deputy Director of Agriculture, Patna Division;

To—The Director of Agriculture, Bihar and Orissa.

I HAVE the honour to send herewith my Annual Report on the Dumraon Farm for the year 1915-16.

Annual Report of the Dumraon Agricultural Station for the year 1915-16.

The Dumraon Agricultural Experimental Station, the oldest in the province, was established in 1895. It is situated in latitude 25° 30″ north on land ying either side of the railway line just east of Dumraon station, East Indian Railway. The land is provided by the Dumraon Raj, who meet all the expenses of the station.

For ten years previous to the opening of the present Farm the Raj maintained another experimental station about 2 miles west of Dumraon, but this was abandoned in 1895, when the present site was selected as more suitable by Dr. Leather, the Imperial Agricultural Chemist.

The area of the farm is about 30 acres, of which about 22 acres are under cultivation, the remainder being occupied by roads, buildings, etc. The soil is a light sandy loam resting on a heavier sub-soil. The following table gives the chemical analysis of the first and second nine inches of the soil :—

Particulars.	First 9 inches.	Second 9 inches.
Insoluble silicates and sand	85·63	80·90
Ferric Oxide	3·82	6·12
Alumina	5·52	6·50
Lime	·38	2·07
Magnesia	·83	1·17
Potash	·58	·73
Soda	·64	...
Phosphoric Acid	·04	·08
Sulphuric Acid	·02	...
Carbonic Acid	·08	·05
Organic matter and combined water	2·46	2·38
Total ...	100·00	100·00

The farm is irrigated from the Bhojpur Distributary of the Sone Canal and there is a well in the northern section which can command a limited area.

The total cost of the farm for the financial year, from April 1st, 1915, to March 31st, 1916, was Rs. 3,058-9-4. The amount paid into the Treasury, together with the value of the produce supplied to the Raj, during the same period was Rs. 1,498-12-0.

Certain deductions may be made from the above totals in order to arrive at the approximate cost of the cultivation and upkeep of the station. These

are detailed below, no account being taken of various miscellaneous items not actually spent on farm upkeep :—

	Rs. a. p.	Rs. a. p.
Total cost of the Experimental station for the year 1915-16.		3,058 9 4
Deduct—		
(1) Pay, pension contribution and travelling allowance of the Superintendent and office.	1,127 10 2	
(2) Postage and Telegraph charges ...	24 0 0	
(3) Office expenses, furniture, etc. ...	71 2 6	
		1,222 12 8
		1,835 12 8
Total paid into the Treasury, or supplied to the Raj during the year 1915-16.		1,498 12 0
Add—		
(1) Stock in hand on March 31st, 1916 ...	624 11 11	
(2) Bills due on March 31st, 1916 ...	34 15 0	
	659 10 11	
Deduct—		
(1) Stock in hand on April 1st, 1915 ...	597 8 5	
(2) Bills due on April 1st, 1915 ...	32 9 6	
	630 1 11	
		29 9 0
Total ...		1,528 5 0

If the above calculations are allowed, a loss is shown of Rs. 307-7-8. This compares very unfavourably with last year, when similar calculations showed a profit.

Character of the Season.

The following table gives the number of rainy days and the rainfall in inches for each month, together with the average rainfall for the last 17 years :—

Month	1915-16		Average of 17 years.
	Number of rainy days.	Rainfall in inches.	Rainfall in inches.
1915 April	*Nil*	*Nil*	0·56
May	2	0·54	0·58
June	6	3·94	4·64
July	18	4·52	9·34
August	22	12·27	11·73
September	12	5·34	7·09
October	3	0·46	0·72
November	1	1·25	0·24
December	*Nil*	*Nil*	0·30
1916 January	*Nil*	*Nil*	0·68
February	3	0·50	0·77
March	*Nil*	*Nil*	0·87
Total ...	67	28·82	37·52

Although the total rainfall was below the average, it was well distributed, and the year was favourable.

Experimental Work on the Farm.

From July 1st to October 11th, 1915, the Farm was in the immediate charge of Babu Banke Behari Sahai, from October 12th, 1915 to June 8th, 1916, Babu Promotha Nath Sen Gupta was in charge, but on that date he was transferred, as he was not yet competent to manage a farm, and for the remainder of the year Babu Hari Das Gupta was in charge.

Rice.—*Oryza sativa.*

I.—Manurial Experiments.

Manure applied per acre.	Outturn per acre in pounds.		Profit (+) or Loss (—) in Rupees per acre.
	Grain.	Straw.	
			Rs. a.
400 lbs of cowdung	2,132	3,690	+ 47 9
8,200 lbs of cowdung	1,998	3,484	+ 38 12
2,788 lbs. of cowdung + 307·5 lbs. of castor cake.	2,095	3,740	+ 38 4
Green manure—sannai—*Crotolovia juncia* ...	1,931	4,202	+ 41 0
Green manure—dhaincha (Sesbana aculeata) ...	1,449	3,484	+ 18 10
246 lbs. of bone-meal + and 82 lbs of saltpetre	1,586	2,510	— 10 11
Unmanured	1,009	2,356	+ 8 4

The series was carried out on $\frac{1}{5}$th-acre plots, the variety transplanted being *Maharajwa*, a local coarse rice. The details of the *Pairs* crop following the paddy are not given, as the crop was a failure.

II.—Variety Experiments.

Variety.	Outturn per acre, in pounds.	
	Grain.	Straw.
Maharajwa	1,541	2,562
Bansphul	1,847	2,665
Srikoli	1,109	2,665
Badshahbhog	1,109	2,870
Dadkhani	1,312	2,920
Kalamdan	1,792	2,460

Of the above varieties *Maharajwa*, *Bansphul*, *Srikoli* and *Kalamdan* are local, *Badshahbhog* and *Dadkhani* are Bengal rice. *Maharajwa* is a coarse rice, *Kalamdan* medium, the rest fine.

In addition to the above, the following experiments should have been carried out:—

Gram (*Cicer arietinum*) as a *paira* crop in the rice manurial plots, cultivation experiments on maize (*Zia mays*) and wheat (*Triticum vulgare*) manurial experiments on maize and wheat, variety experiments on wheat and mustard (*Brassic spp.*) seed rate experiments on wheat.

While I am doubtful of the accuracy of the results of the varietal experiments on rice given above, I know that the records of the remaining experiments are useless, and they are, therefore, not recorded. The failure is due to the want of practical knowledge, and of training in experimental work of the Superintendent, who was appointed from Sabour. It is a well-known fact that a man with no knowledge of practical agriculture cannot learn this sufficiently during a College course to enable him to occupy a responsible position where such knowledge is essential, but requires considerable further training.

G. SHERRARD,

Deputy Director of Agriculture.

No. 1231-D., dated Cuttack, the 8th August 1916.

From—D. R. SETHI, Esq., M.A., B.Sc., Deputy Director of Agriculture, Orissa,

To—The Director of Agriculture, Bihar and Orissa.

With reference to your letter No. 5378, dated the 7th July 1916, I have the honour to submit herewith a detailed report of the Cuttack Agricultural Station for the year 1915-16.

Annual Report of the Cuttack Agricultural Station for the year 1915-16.

I.—A. SITE.

(*a*) The Cuttack Agricultural Station is situated in the villages of Bidyadharpur, Kanipur and Bhadimul about 6 miles along the Taldanda Road from the Civil Station. The farm is irrigated by the Taldanda Canal which flows on the southern side of the farm, while the river Mahanadi flows on the northern side.

(*b*) *Area.*—The station occupies an area of 120 acres of which 84 acres are under cultivation. The remaining 36 acres are taken up by tanks (about 20 acres), buildings, roads, and irrigation and drainage channels.

(*c*) *Brief history.*—The station was started in March 1904 when about 70 acres of land were taken over. This area was increased in 1908-09 to 120 acres, and in another two years this increased area was also brought under control.

II.—SOIL.

Below is an analysis of the farm soil.—The soil is mostly a light loam in the low-lying fields, while the higher plots are mostly sandy.

Particulars.	Surface soil, first 9 inches, per cent.	Sub soil, second 9 inches per cent.
1	2	3
Insoluble silicates and sand	86·66	84.33
Ferric oxide	3·74	4·83
Alumina	5·52	6·37
Lime	·30	·39
Magnesia	59	·41
Potash	·24	·33
Soda	·03	·17
Phosphoric Acid	·03	·03
Sulphuric Acid	·01	·007
Carbonic Acid	·05	·06
Organic matter and combined water*	2·83	3·07
Total ...	100·00	100·00
Containing nitrogen	004	.004

III.—OBJECTS OF THE STATION.

1. The main work of the station is to solve different problems connected with the cultivation of rice as this is the most important and staple crop of the Orissa Division. Experiments on the various modes of manuring, sowing, cultivating, etc., are carried on with a view to find out the most economical method.

2. From this year onwards the energies of the station will be also devoted to the study of the different rices of this Division with the object of improving the same.

3. To conduct experiments with various other crops such as sugarcane, jute, potatoes, groundnuts, cereals and various legumes, etc.

4. To supply the recommended seeds, manures, and implements to cultivators and others.

5. To demonstrate the improved implements, and methods of cultivation.

6. To render necessary assistance to private farms, co-operative societies and others interested in agriculture.

IV.—SEASON.

The rainfall during the year although above normal was very irregular. June and July had insufficient rain while October and November were far above the normal. The heavy downpour in these last two months was accompanied by a severe cyclone and these two factors were mainly responsible for the failure of almost all the *rabi* crops as well as the damage to the paddy crop. The following table gives the rainfall of the year under report together with an average for the last 8 years:—

Months.	Average of eight years including 1914-1915.	No. of rainy days.	1915-16.
	Rainfall in inches.		Rainfall in inches.
1	2	3	4
April 1915	1·89	2	2·30
May „	2·70	7	3·32
June „	9·76	12	6·81
July „	13·91	15	7·12
August „	16·10	17	2·93
Septem „	8·84	20	10·34
October „	3·81	12	9·2
November „	0·62	9	10·00
December „	0·43	...	...
January 1916	0·27	...	...
February „	0·83	...	...
March „	0·67	...	...
Total ...	59·83	94	62·23

V.—EXPERIMENTS.

A.—Rice.

(*a*) *Manurial experiments* :—(*i*). The object of the following experiments was to compare the value of different chemical manures for irrigated transplanted rice. The experiments were carried out in duplicate on $\frac{1}{5}$th acre plots. The variety transplanted was Khura, a local coarse rice. Under the present conditions the manures did not pay for themselves, and I doubt very much if these artificial manures with their present high prices will ever pay when applied to rice crop. The experiments however will be continued as they supply information which is of great scientific interest. The following table gives the results of these experiments :—

Manure per acre.	Outturn in pounds, per acre.				Cost of Cultivation, per acre.	Value of yield, per acre.	Profit.
	1914-15.		1915-16.				
	Grain.	Straw.	Grain.	Straw.			
1	2	3	4	5	6	7	8
					Rs. a. p.	Rs. a. p.	Rs. a. p.
Sulphate of Ammonia .. 160lbs. Superphosphate ... ... 120 ,, Muriate of Potash ... 100 ,,	2,406	6,662	2,577	3,193	63 15 4	82 6 9	18 7 5
Muriate of Potash ... 100 ,, Sulphate of Ammonia ... 160 ,,	2,388	6,611	2,512	4,130	52 1 9	84 3 2½	32 1 5½
Superphosphate ... ... 120 ,, Sulphate of Ammonia ... 160 ,,	2,470	6,995	2,470	4,150	54 10 9½	82 4 10½	27 10 1
Superphosphate ... ... 120 ,, Muriate of Potash ... 100 ,,	1,999	4,546	2,031	2,640	44 4 8½	65 5 11½	21 1 3½
No Manure.	1,947	4,433	1,901	2,008	20 9 5½	59 11 5½	39 2 ½

(*ii*) The object of the following experiments was to compare the effect of various heavy manures for irrigated transplanted rice. The experiments were carried out in duplicate on $\frac{1}{5}$th acre plots, the variety transplanted being Badshahbhog, a fine Bengal rice. The name "Khatto" is given to the dry powdered mixture of cowdung and ashes, which the cultivator applies to his lands, while "Cowdung" denotes that which is made in properly constructed covered pits on the Experimental Station, and which naturally is richer than the village manure. It will be seen that the best manure for transplanted rice is *dhaincha* green-manure. It is the cheapest manure and gives the heaviest yield, hence it is the most economical manure. The following table gives the results of these experiments :—

Manure per acre.	Outturn in lbs., per acre, 1915-16.		Cost of Cultivation, per acre.	Value of yield, per acre.	Profit.
	Grain.	Straw.			
1	2	3	4	5	6
			Rs. a. p.	Rs. a. p.	Rs. a. p.
Unmanured	1,505	2,229	18 2 8¾	66 6 4¾	48 3 8
Khatto, 4,100 lbs, ...	1,698	2,562	20 11 10½	75 0 5	54 4 6½
Cowdung, 4,100 lbs, ...	1,763	2,654	21 10 6¾	77 15 7½	56 5 ¼
Dhaincha—Green manure	1,957	2,721	20 8 ¼	85 14 3½	65 6 3

(*iii*) The object of the following experiment was to find out a method for green manuring broadcasted rice fields with *Dhaincha*. Almost the whole of the rice crop of this Division is broadcasted and the only successful method of green-manuring rice fields known to this station involves the more laborious but at the same time more paying system of transplanting rice. This last forms a real obstacle in the way of introducing the green-manuring operation in this

Division—as the people are backward and do not like to spend the extra labour required in transplanting rice. In order, therefore, to find a suitable method of green-manuring the broadcasted fields the following plan was devised. Dhaincha seed at the rate of 10 lbs to the acre was mixed with the necessary quantity of seed paddy and broadcasted in the fields. The Dhaincha plants along with rice are allowed to grow for about a month, when the former is ploughed and buried into the soil at the time of weeding the broadcasted crop. The plowing up of *dhaincha* plants is made possible through the unique system of "Beushan" prevalent in this Division. By this system broadcasted fields of rice are plowed and cross-plowed in the month of July. This operation helps to thin the growing crop and stir up the soil a little. The plough was passed through the land and most of the *dhaincha* plants were uprooted. These and also those few which were not uprooted were buried in the soil when the field was weeded, which operation follows the "beushaning" of the land immediately. The following table gives the results of the year's experiment. The results although not very satisfactory, are none-the-less encouraging and the experiment will be continued before any conclusions can be arrived at :—

Manure.	Outturn in pounds, per acre.		Cost of cultivation, per acre.	Value of yield, per acre.	Profit.
	1915-16.				
	Grain.	Straw.			
1	2	3	4	5	6
			Rs. a. p.	Rs. a. p.	Rs. a. p.
Dhaincha—green-manure	2,328	3,088	24 14 5½	75 1 1½	50 2 8½
Unmanured	2,182	2,702	24 6 7½	69 12 1½	45 5 6½

(*b*) *Varietal Experiments* :—(*i*) The object of the experiment was to compare the yields of different quality of rices amongst themselves. The experiment was conducted in duplicate on $\frac{1}{5}$th acre plots and no manure was given Of the rices mentioned in the following table the first three, *i.e.*, Dadkhani, Samudrabali and Badshabhog, are fine Bengal rices while Khasagundi, is a fine local rice. The remainder three, *i.e.*, Hunda, Khura and Benafuli are local coarse varieties :—

Variety.	Outturn in pounds, per acre.				Cost of cultivation, per acre.	Value of yield, per acre.	Profit.
	Average for eleven years including 1914-15.		1915-16.				
	Grain.	Straw.	Grain.	Straw.			
1	2	3	4	5	6	7	8
					Rs. a. p.	Rs. a. p.	Rs. a. p.
Dadkhani	2,031	4,063	1,650	3,535	18 14 1	71 2 4	53 4 3
Samudrabali	2,115	3,789	1,668	2,820	18 11 2	69 9 9	50 14 7
Badshabhog	2,387	3,717	1,732	3,590	18 10 4	79 13 1	61 2 9
Khasagundi	2,235	3,749	1,562	2,560	17 11 9	64 15 7	47 3 10
Hunda	2,458	4,293	1,886	2,358	17 3 10	64 11 0	47 7 2
Khura	2,595	4,971	2,408	2,972	18 1 2	76 15 3	58 14 1
Benafuli	2,260	4,150	2,280	2,098	17 1 4	73 9 1	56 7 9

(*ii*) The following table gives the results of tests carried out for comparative yield on three transplanted *Aus* or Autumn rices :—

Variety.	Outturn in pounds, per acre.				Cost of cultivation, per acre.	Value of yield, per acre.	Profit.
	Average of 2 years including 1914-15.		1915-16.				
	Grain.	Straw.	Grain.	Straw.			
1	2	3	4	5	6	7	8
					Rs. a. p.	Rs. a. p.	Rs. a. p.
Tulsiful	1,563	4,639	1,917	2,500	24 3 6	51 11 6	27 8 0
Benibhog	1,530	2,639	2,075	3,000	25 11 3	62 15 11	37 4 8
C. P. Fine	1,537	3,300	1,538	3,200	28 10 9	53 4 6	24 9 9

(*c*) *Seedling Experiment* :—(*i*) The object of this experiment is to ascertain the most economical seedling-rate for transplanted rice. The plots were $\frac{1}{5}$th acre and the experiment was conducted in duplicate. All the plots were green-manured with *dhaincha*. It will be seen from the following table of results that not only there is a saving in seed, but the outturn is also increased by transplanting a lesser number of seedlings. It must, however, be remembered that the results have been obtained on irrigated lands and therefore are only applicable to those localities where similar conditions prevail :—

Method of transplanting.	Outturn in pounds, per acre.				Cost of cultivation, per acre.	Value of yield, per acre.	Profit.
	Average of nine years including 1914-15.		1915-16.				
	Grain.	Straw.	Grain.	Straw.			
1	2	3	4	5	6	7	8
					Rs. a. p.	Rs. a. p.	Rs. a. p.
One seedling per hole ...	2,244	3,584	1,660	2,678	24 8 11	63 13 8	39 4 9
Two seedlings per hole ...	2,242	3,766	1,545	2,644	26 5 $\frac{1}{2}$	59 14 10$\frac{1}{2}$	33 9 9$\frac{1}{2}$
Four seedlings per hole ...	2,237	4,137	1,746	2,572	31 3 9$\frac{1}{2}$	67 5 7$\frac{1}{2}$	36 1 9$\frac{1}{2}$
Eight seedlings per hole ...	2,223	4,349	1,727	3,080	40 3 1$\frac{1}{2}$	67 4 11$\frac{1}{2}$	27 1 10$\frac{1}{2}$

(*ii*) In addition to the above, a further similar experiment was carried out to demonstrate the advantages of recommended method of transplanting 2 or 3 seedlings 9 or 10 inches apart, compared with common practice of transplant-

ing 10 or 12 seedlings, 5 or 6 inches apart, when the fields are transplanted in the beginning of the season. The results are given in the following table :—

	Outturn in pounds, per acre.				Cost of cultivation, per acre.	Value of yield, per acre.	Profit.
	Average of 3 years including 1914-15.		1915-16.				
	Grain.	Straw.	Grain.	Straw.			
1	2	3	4	5	6	7	8
					Rs. a. p.	Rs. a. p.	Rs. a. p.
Farm Method	2,487	4,160	1,862	3,505	26 1 1	81 8 3½	58 7 2½
Local Method	2,165	4,572	1,718	4,276	31 0 5½	81 3 0½	50 2 7½

(*d*) *Cultivation Experiment* :—(*i*) The object of these experiments is to compare the outturns of broadcasted with transplanted rice. The plots were not to be irrigated unless found absolutely necessary. The experiment was carried out in duplicate on $\frac{1}{5}$th acre plots, and the results given, in the table below, are the averages :—

Method of Cultivation.	Outturn in pounds, per acre.		Cost of cultivation, per acre.	Value of yield, per acre.	Profit.
	1915-16.				
	Grain.	Straw.			
1	2	3	4	5	6
			Rs. a p.	Rs. a. p.	Rs. a. p.
Transplanting	1,927	2,362	19 4 0½	61 9 7	42 5 6½
Broadcasting	1,684	1,942	23 5 5½	53 10 1½	30 4 11½

(*ii*) Hot weather *versus* monsoon cultivation of paddy fields. The object of this experiment is to find out what effect, if any,—hot weather cultivation has on the outturn of transplanted rice, as compared to fields which are never opened up until the first rains have set in. One good effect of hot weather cultivation on the plots was that the grasses and weeds were practically killed out by exposure to the severe sun of April and May, and consequently there was less expense in weeding the paddy crop on these plots. Of course the expense of cultivating the plots ploughed during April and May was a little more but the extra yield obtained from these plots more than makes up for extra cost incurred. The table below gives the averages of two $\frac{1}{5}$th acre each, plots in each case :—

	Outturn in pounds, per acre.		Cost of cultivation, per acre.	Value of yield, per acre.	Profit.
	1915-16.				
	Grain.	Straw.			
1	2	3	4	5	6
			Rs. a. p	Rs. a. p.	Rs. a. p.
Monsoon Cultivation (ploughing in June) ...	1,107	1,537	17 14 3	45 4 4½	27 6 1½
Hot Weather Cultivation (ploughing in April) ...	1,353	1,706	19 5 2	54 11 2½	35 6 0½

(*iii*) The object of this experiment was to compare the outturns of broadcasted rice lands cultivated with Meston plough and country plough. The table below gives the average outturn of two plots in each case :—

	Outturn in pounds, per acre.				Cost of cultivation, per acre.	Value of yield, per acre.	Profit.
	Average of 2 years including 1914-15.		1915-16.				
	Grain.	Straw.	Grain.	Straw.			
1	2	3	4	5	6	7	8
					Rs. a. p.	Rs. a. p.	Rs. a. p.
Land cultivated with Local plough.	1,669	...	887	1,230	12 10 8½	30 13 1½	18 2 5
Land cultivated with Meston plough.	1,673	...	919	1,366	13 8 3	32 3 7½	18 11 4½

(*iv*) *Rotation Experiment.*—Jute and rice were rotated on the same fields in one season. Jute was removed from fibre in the month of August and rice was then transplanted. The lands were irrigated, and cowdung at the rate of 16,000 lbs per acre was applied to jute crop. The following table gives the average results of duplicate plots :—

Crop.	Outturn in pounds, per acre.						Cost of cultivation, per acre.	Value of yield, per Acre.	Profit.
	Average of four years including 1915-16.			1915-16.					
	Grain.	Straw.	Fibre.	Grain.	Straw.	Fibre.			
1	2	3	4	5	6	7	8	9	10
							Rs. a. p.	Rs. a. p.	Rs. a. p.
Jute	...	...	843	...	...	1,122	52 0 8	85 9	33 8 1
Rice	2,153	3,027	...	1,754	2,290	...	15 0 0	49 15 6	34 15 6

(*e*) *Seed-rate Experiment.*—The object of these experiments is to find out the most economical seed-rate for broadcasted rice. The seed-rate for broadcasted rice in the five districts of this Division varies from 123 lbs. down to 61 lbs. The after cultivation of broadcasted rice consists in ploughing through the crop a month or so after it is sown, and this practice is common to the whole Division. This operation is known by three different names of "Beushan", "Bihuda" and "Garamara". The reason given by the cultivators of this Division for this practice is that it checks the weeds, thins the crop, and loosens the soil. This is quite true ; and the difference in the appearance of a field, which has had 123 lbs. of seed rice, before and after "Beushan" is very remarkable. Before the operation the field looks like a seed-bed and the plants look sickly, while after the "beushaning" the field is quite thin, and one is apt to take it for a transplanted field, while the plants take on a dark green colour. The "beushaning" of the fields, I believe, is necessary because firstly the fields are not cultivated thoroughly before sowing and, secondly, the seed-rate is too high. To test the validity of this opinion an experiment was devised and included in the seed-rate experiment. The seed-rate was to be 41 lbs. per acre, and the lands were given 6 ploughings and two ladderings in oder to bring them into a proper state for seeding. No "beushan"

was done but the plots were weeded once at the same time as the " Beushaned " ones. Statements Nos. 3 and 4 in the following table gives the results of these as compared to 40 lbs. plots which were " Beushaned ". This year's results are quite encouraging and the experiment will be repeated next year.

From the first three statements in the table below it will be seen that the usual seed-rate given in Orissa may profitably be reduced to 41 to 51 lbs. per acre. This will not only save 41 to 61 lbs. of seed rice, but will also increase the net profit.

All the experiments were conducted in duplicate on $\frac{1}{5}$th acre plots, and the results given in the following table are averages:—

Quantity of seed sown per acre.	Out turn in pounds, per acre.				Cost of cultivation, per acre,	Value of yield, per acre.	Profit.
	1914-15		1915-16.				
	Grain.	Straw.	Grain.	Straw.			
1	2	3	4	5	6	7	8
					Rs. a. p.	Rs. a. p.	Rs. a. p.
1. Eightyt-wo pounds	1,481	2,470	1,555	1,845	18 3 8	49 7 8	31 4 0
2. Si ty-one poudns	1,317	2,255	1,524	1,538	18 9 6	47 3 7½	28 10 1½
3. F rty-one pounds	1,532	3,270	1,570	1,891	17 14 4½	50 1 1½	32 2 9½
4. Ditto without (" Beushan ")	1,783	3,198	1,491	2,357	16 12 9	49 3 1[illegible]	32 7 2

(*f*) *Seed-selection.*—Two simple ways of selecting good seeds for sowing were tried. In one case the seeds were selected by passing through the sieve and only those were sown which did not pass through the sieve and in the other the seeds were soaked in a saturated solution of salt and only those that sank were sown. The experiments in every case were carried out in duplicate, the plots being $\frac{1}{5}$th acre each. It will be seen from the average results given in the following table that the selected seeds in both cases gave better results than the unselected ones, and well repaid the extra labour in selecting the seeds :—

Seed-selection.	Outturn in pounds, per acre.				Cost of cultivation per acre.	Value of yield, per acre.	Profit.
	1914-15.		1915-16.				
	Grain.	Straw.	Grain.	Straw.			
1	2	3	4	5	6	7	8
					Rs. a. p.	Rs. a. p.	Rs. a. p.
Land sown with seed that did not pass through the sieve.	1,871	2,870	1,638	2,293	23 11 7	53 2 8½	29 7
Land sown with unselected seed ...	1,842	2,767	1,645	2,060	24 10 7	52 10 11	28 0 4
Land sown with seed that sank in saturated salt solution.	1,826	2,829	2,196	2,234	22 9 9½	68 11 8½	46 1 11
Land sown with unselected seed.	1,771	2,562	1,827	2,398	22 7 4½	58 13 5½	36 6 1

B.—JUTE.

Four varieties of jute from different places were tried. The experiment was carried out in duplicate on $\frac{1}{5}$th acre plots, and the results given in the

following table are averages. "Kendrapara" is the name given to the variety which is commonly grown in the jute-growing tract of Cuttack district.

Variety.	1915-16, outturn of fibre in lbs., per acre.	Cost of cultivation, per acre.	Value of yield, per acre.	Profit.
1	2	3	4	5
		Rs. a. p.	Rs. a. p.	Rs. a. p.
Kendrapara	1,015	59 1 3¾	77 5 6	18 4 2¼
Mymensingh ...	789	57 3 2½	60 2 6	2 15 3½
Rajshahi	907	56 14 8¾	69 3 1	12 4 4¼
Barapal of Chinsurah ...	994	5[illegible] 1¼ 8¾	7[illegible] 12 6	18 13 9¼

C.—Groundnuts.

Although consumed in large quantities the crop is not cultivated by the people in this Division, and most of it is imported from Madras. With a view to the introduction of this valuable II crop on suitable lands in this Division, variety trials have been going on on this farm for the last 5 years. No pain was taken to keep the different varieties pure and consequently they were hopelessly mixed up. The results given in the following table are from the seed of these mixed varieties. Next season the whole of the stock will be disposed off and new and pure seed of different varieties will be obtained for trial purposes.

The results given in the following table are the averages of duplicate $\frac{1}{10}$th acre plots. Nearly a half of the crop was lost in the ground owing to the heavy rains at harvest time and the consequent difficulty of lifting the crop:—

Variety.	1915-16, Outturn in lbs., per acre.	Cost of cultivation, per acre.	Value of yield, per acre.	Profit or loss.	Remarks.
1	2	3	4	5	6
		Rs. a. p.	Rs. a p.	Rs. a. p.	
Madras ...	799	69 7 3	60 15 0	8 8 3	Loss.
Japan	1,037	71 9 0	79 1 7½	7 8 7½	Profit.
Cuttack ...	991	67 3 10	75 9 4½	8 5 6½	Do.
Pondicherry ...	1,303	60 10 10	99 6 - 7½	38 11 9½	Do.
Verginia ...	1,042	67 7 2	79 7 10½	12 0 8½	Do.

D.—Peas.

Two varieties of Patna Peas (Sabour Nos. 1 and 2) were tried on the farm and the following table gives the results. These peas are bigger than either

Patna peas or the farm peas, and yield much more than either of the last two.

Variety.	1915-16, Outturn in lbs., per acre.	Cost of cultivation, per acre.	Value of yield, per acre.	Profit.
1	2	3	4	5
		Rs. a. p.	Rs. a. p.	Rs. a. p.
No. 1	861	33 8 3	78 12 0	45 3 9
No. 2	584	33 10 4	53 7 0	19 12 8

E.—Miscellaneous.

Bihar system of broadcasting a leguminous crop in the standing paddy crop, a few days before harvesting, was tried again this year. The crops tried were gram and *khesari*, but they failed to germinate owing to heavy outbreak of rains soon after sowing.

Various other crops such as potatoes, sun-hemp, gram, wheat, oats, cow-peas, *arhar*, linseed, lentils, *kulthi*, *mung*, etc., were tried on a small scale on the farm, the object being to find out their suitability to this locality.

VI.—STATEMENT SHOWING RECEIPTS AND EXPENDITURE OF THE CUTTACK AGRICULTURAL STATION FOR 1915-16.

Assets.

		Rs. a. p.
Amount remitted to Treasury ...		3,988 14 4
Stock in hand on 31st March 1916		1,564 12 3
Bills due on 31st March 1916 ..		156 8 9
Gross Receipts ...		5,710 3 4
Stock in hand on 1st April 1915 ...	1,237 4 3	
Bills due on 1st April 1915 ...	155 11 8	
Deduct— Total ...		1,392 15 11
Net Receipts		4,317 3 5
Loss due to experimental work, etc.		545 8 0
Total ...		4,862 11 5

Liabilities.

		Rs. a. p.
Pay and travelling allowance of staff		2,103 3 9
Office expenses, *e.g.*:— Postage and telegram charges, Hot weather charges, 'Office expenses, Repairs and purchase of Furniture		70 11 10
Cost of bullocks		1,199 0 0
Cost of one weigh-bridge and its fittings		745 0 0
Cost of a Winnowing machine, Punjab Plows, Harrows, etc. ...		479 10 0
Cost of cultivation, *i.e.*, money actually spent on the upkeep of the station		4,710 10 2
Cost of water rates		152 1 3
Total ...		9,460 5 0
Pay and Travelling allowance of staff ...	2,103 3 9	
Office expenses...	70 11 10	
Non-recurring expenditure	2,423 10 0	
Deduct— Total ...		4,597 9 7
Total ...		4,862 11 5

VII.—MISCELLANEOUS.

A.—Demonstration conducted on the farm.

Two demonstrations on the method of green-manuring rice lands were conducted on the farm. These demonstrations were attended by nearly 300 cultivators from different parts of Cuttack and Puri districts.

The proper method of ploughing in the Dhaincha crop for green-manuring rice was demonstrated to the visitors, and the improved method of transplanting with a smaller number of seedlings at a bigger distance was also shown.

The second demonstration was the comparison between the working of the Local, Meston, and Hindustan ploughs. In order to satisfy their objections, the cultivators were invited to try both the ploughs themselves, which they did.

All the visitors on this occasion were conducted over the farm by me and the Farm Superintendent, and the object of the various experiments under progress explained to them.

B.—Seed supply.

Various seeds were supplied to the public during the year. Except a certain amount of Dhaincha and sugarcane, almost all the seeds were supplied from the Station stock. The following statement gives the quantity of every seed, manure and implements supplied :—

Name of seeds, etc.	Quantity supplied in lbs. (82 lbs. per maund).
1. Badshabhog	1,346
2. Samudrabali	219
3. Khasagundi	39
4. Dadkhani	695
5. C. P. Fine (Aus)	1,491
6. Chingarbhusi (Balam)	94
7. Benafuli	2
8. Hatisal	45
9. Khura	106
10. Benibhog	564
11. Tulsiful (Aus)	10
12. Hunda	41
13. Dhaincha	4,434
14. Groundnuts :— (Verginia)	103
(Cuttack)	82
(Japan)	1,124
(Pondicherry)	621
(Spanish Pea-nuts)	6
15. Patna Pea	7
16. Farm Peas	6
17. Lentil	22
18. Arahar	150
19. Jute :— (Mymensingh)	24
(Kakya Bombai)	32
(Chinsurah)	43
20. Maize	38
21. Pusa Wheat	16
22. Plantain suckers No.	56
23. Paddy seedlings	710 bundles.
24. Bone-meal	213
25. Sulphate of ammonia	72
26. Mungo seed canes	23,600 whole canes.
27. Mung	172
28. Kusum seeds	82
29. Potato seeds	328
30. Meston Ploughs, No.	30
31. Gur-boiling Pans, No.	14
32. Hathi Cane-crushing Mill, No	1
33. Ramnarain Banerjee's Cane-crushing Mill, No. ...	11

C.—Visitors and Inspection.

The Director of Agriculture, Bihar and Orissa, inspected the station three times during the year under report, i. e., in August, 1915, November, 1915 and June, 1916.

The following officials visited the station frequently :—

1. The Collector of Cuttack District.
2. The Registrar of Co-operative Societies.
3. The Superintending Engineer, Orissa Circle.
4. The Executive Engineer, Mahanadi Division.
5. The Manager, Darpan Ward's Estate.
6. Subdivisional Officer, Kendrapara.
7. The Sub-Manager, Kujang Estate.

Various other gentlemen visited the Experimental Station.

D.—Charge of the Station.

During the year under report the station was in the immediate charge of Babu Raj Nath Ray from 1st July, 1915, to 30th November, 1915, when he was transferred to Puri as the Agricultural Inspector of that District with headquarters at Khurda. He gave over charge of the farm to Babu Madan Mohan Pradhan who has remained in charge of the station during the remainder part of the year. The Farm Superintendent is assisted by two overseers and one clerk.

During the year under report five boys of cultivating classes were under training on the station.

VIII.—ACKNOWLEDGMENTS.

The Economic Botanist, Bihar and Orissa, very kindly gave valuable advice in combating crop pests of the farm and in the Division during the year under report.

D. R. SETHI,

Deputy Director of Agriculture, Orissa Division.

No. $\frac{627}{11\text{-A.-7B. of 16.}}$ dated Ranchi, the 22nd August 1916.

From—A. C. DOBBS, Esq., Deputy Director of Agriculture, Chota Nagpur Division, Ranchi,

To—The Director of Agriculture, Bihar and Orissa, Ranchi.

With reference to your letter No. 5377 of 7th July, 1916 and a subsequent reminder I have the honour to submit herewith the first Annual Report of the Ranchi Farm—for the year ending June 30th, 1916.

First Annual Report of the Ranchi Farm for the year ending 30th June 1916.

SITUATION.

The Ranchi Farm is situated 5 miles to the north of the town of Ranchi on the Pithoria Road. It lies a mile or so to the south of the Tropic of Cancer at an elevation of about 2,100 feet.

The land consists of the side and part of the top of a hill, and a valley: it was well chosen, in that almost all the field conditions of the Chota Nagpur Plateau are represented within its boundaries.

SOILS.

The upland soil is a red loam, deep on the top of the hill, but thinning out where the sides have not been terraced, and the underlying rock has been exposed by the weather. The steeper part of the slope has, however, been terraced, and consisted, when the land was taken over, of innumerable small irregular paddy-fields at all levels.

The valley bottom, which is liable to be flooded by a sudden rush of water from the high land surrounding the farm, has also been terraced, forming a more or less regular series of paddy-fields of the type known on the Plateau as 'garha dons', which are wet even in the driest season, and contain numerous perennial springs fed by the slow drainage of the subsoil water from the surrounding upland.

The tables below give the result of analyses made by the Agricultural Chemist, Sabour, of samples of soil from the farm, and show the effect of the washing of the fine soil from the surface of the upland into the paddy-fields.

The peculiarities of the soil are the large amounts it contains of potash and iron, the small quantity of lime and the minute proportion of phosphoric acid.

ANALYSES OF RANCHI SOIL.

—	Lowland surface soil.	Lowland sub-soil.	Upland surface soil.	Upland sub-soil
1	2	3	4	5
Insoluble Matter	84·200	82·810	89·880	84 500
Potash ... K_2O ...	·613	·513	·387	·604
Soda ... Na_2O ...	·160	·180	·035	·159
Lime ... CaO ...	·218	·254	·117	·158
Magnesia ... MgO ...	·464	·462	·252	·276
Manganese ... Mn_3O_4 ...	Traces	Traces	Traces	Traces
Ferric Oxide ... Fe_2O_3 ...	6·150	7·205	4·080	6·430
Alumina ... Al_2O_3 ...	3·440	3·595	1·940	3·405
Phosphoric Acid P_2O_5 ...	019	·019	·016	·025
Sulphuric Acid ... SO_3 ...	Traces	Traces	Traces	Traces
Carbonic Acid ... CO_2 ...	·288	·310	·212	·240
Volatile Matter*	4·460	4 650	2·820	4·204
Total ...	100·012	99·948	99·739	100·001
* Containing nitrogen	·075	·051	·044	·042

Rainfall.—The average annual rainfall is probably between 40″ and 50″ but it varies very much locally, occurring for the most part in sharply defined showers of small extent.

There was very little rain between July 1st and 23rd, 1915, and from the latter date when observations on the farm began until June 30th, 1915, the total rainfall recorded was 39·19 inches distributed as follows :—

—	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.
1	2	3	4	5	6	7	8	9	10	11	12	13
1915	...	...	...	...	...	...	10·02*	6·26	8·10	1·35	0·74	...
1916	...	0· 6	...	1·68	2·36	8·32	...	...	...	...	...	...

* July 24th to 31st inclusive.

Local Agriculture.—The chief crop on the plateau is rice, the area of which is some 60 per cent. of the total cultivated land. Of this rice area, upland rice, locally known as 'gora dhan', occupies nearly half and lowland rice or 'don dhan' the remainder.

The yield of crops on the upland is a miserable one, though fair yields of 'gora dhan' are secured by leaving the land fallow for 2 or 3 years followed by cultivation throughout the cold and hot seasons previous to sowing the crop.

Owing no doubt to the poor return from the upland, the terraced area has been extended almost to the limit of profitable cultivation in a wet season, with the result that a large portion of the upper terraced area also normally gives a very small outturn.

Even on the lower terraces the yields are usually small compared to those obtained elsewhere, in spite of abundance of water—probably owing to the want of organic matter caused by the feeble growth of vegetation on the upland.

The upland crops other than 'gora dhan' consist mainly of small millets and pulses which are hardly considered worth growing in more naturally fertile tracts.

Problems presented.—The main problem to be solved on the farm is therefore to make a more reasonable use of the considerable rainfall, and of the advantages offered by a well-drained loamy soil containing enormous reserves of potash—one of the most expensive manures to buy.

It is quite clear, from the good crops of maize and mustard occasionally seen on highly manured land on the plateau, that—given the right manure—as large and valuable crops can be grown here as anywhere else in India where the rainfall is similar.

An incidental problem is to find crops, suited to the soil, of sufficient commercial value to pay for such purchased manures as may be necessary to supplement the soil's chemical deficiencies.

Buildings.—The farm is equipped with a shed for 35 head of cattle and for implements, a seed store and weigh bridge, and an office; besides quarters for overseers, and godowns for coolies.

A bungalow for the Divisional Deputy Director of Agriculture has also been built on the farm, and was completed in November 1915.

Livestock.—Of 20 bullocks bought by the Superintendent of the Sepaya Farm at Sonepur in 1914, at a cost of Rs. 225 per pair, one died, and the remainder were sent to Ranchi at the end of April 1915. One of these

consistently refused to do anything but the lightest work and, perhaps fortunately, died of anthrax in June, 1915.

Four cows, a bull, and a young bullock of the Montgomery breed were obtained from Pusa. The bull and bullock have been trained to the plough, and the cows have given milk to the value of Rs. 393, besides rearing four good calves in the year.

Implements.—The advantage of having heavy bullocks is to enable large implements to be used, thus economising considerably in labour. The Farm has therefore been equipped with 'Punjab' ploughs, spring-tined cultivators, a zig-zag and a chain harrow, and heavy 'hengas'.

For superficial work the spring-tined cultivator gets over five times the area covered by the local plough in the same time with equal effect; and at the beginning and end of the rains the Punjab plough does at least twice the work of the local plough. Local ploughs are used for deep work in land that has already been cultivated, in the dry season, and for puddling paddy land.

A threshing machine and winnower have been obtained for special purposes, and a chaff cutter for cutting coarse fodder and silage.

Some American double-wheeled hand-hoes have been procured for weeding crops sown in lines, and having been found to economise a large amount of labour, the system of growing crops in lines is being largely extended on the farm and recommended in the district.

Laying out.—The area of the farm is about 140 acres, containing, besides roads, about 60 acres of cultivable upland and a similar area of paddy land.

Work was begun in May 1915, but little could be done before the monsoon because of the hard state of the ground, which had not been cultivated during the previous year. Cultivation of the upland ordinarily begins in January or earlier.

The principal work done was therefore to lay out the land with a view to ease of control for experimental and demonstration purposes, and so as to make the maximum use of the large amount of water received from higher land and to minimise the damage done by sudden floods.

The upland was divided systematically into strips of uniform width by *bandhs* running across the slopes so as to prevent wash and to concentrate the water into two large tanks, formed by running high *bandhs* across the lower sides of hollows between the upland and the paddy land. A large part of the paddy land was laid out in similar strips, the old levels being ignored. This necessarily interfered to a great extent with the cultivation of paddy during 1915, and the area grown was only 10 acres.

Sixty experimental plots were laid out on 6 acres of the least uneven portion of the upland and separated by small '*ails*'.

About an acre of the lowest of the paddy-fields which were full of springs over which it was impossible to walk, even in the hot weather, have been drained, —with bricks rejected for building purposes and procured at a cheap rate near the spot. The water from the drains can be used for irrigation in the hot weather if necessary.

A row of bamboos has been planted along the road on the west side of the farm, and a mango tope of about an acre in a field that was not convenient for systematic cultivation.

Cropping.

Indigenous crops—The local crops grown in 1915 were *urid*, *rahar* and lowland paddy.

The *urid* and *rahar* grew very luxuriantly on land that was limed, but poorly elsewhere. The outturn all over was small, and did not repay the cost of cultivation.

Owing to the old paddy *bandhs* not having been repaired for a year or two and the new ones not being completed very little paddy was grown and most of it was transplanted late and gave a poor out-turn.

Introduced crops.—A strain of a coarse variety of paddy called 'Indursail' was obtained from Mr. Hector, Economic Botanist to the Government of Bengal, who had selected it on account of its heavy yield at Dacca. It was grown under observation and gave a heavy yield on an area of about a quarter of an acre. A larger area was sown with this variety for transplanting during the 1916 monsoon. Owing to the unevenness of the paddy land, no strict comparison with other varieties was possible. The local variety 'Kalamdan' gave a heavy yield; other varieties obtained from Sabour and one from Bombay gave relatively smaller outturns.

A small area of C. P. *aus* paddy has been sown on the upland during the current season for comparison with the local 'gora dhan'.

Groundnut was selected as a crop for the experimental area, and seed for six acres was obtained through the courtesy of Mr. Clouston, Deputy Director of Agriculture, Nagpur,—the variety being that grown locally at Raipur in the Central Provinces. Several samples of different varieties were also obtained from Cuttack for growing under observation.

The crop was an unqualified success, in spite of the facts that none of the staff had ever seen the crop before and that it was not planted until July 13th owing to the late preparation of the ground. Two hundred maunds, worth at local prices Rs. 1,000, were obtained from seven acres. The cultivation and harvesting were expensive, costing some Rs. 645 in all, including the cost of manures for the experiments; but by earlier sowing, a choice of varieties and by the use of the wheeled-hoes mentioned above and of the lessons learnt by the manurial experiments, very great routine economies have been effected in the current season, and there is still much more that can be done in the same direction.

The crop will almost certainly become, in time, the staple crop of the Plateau, as it has of certain districts of Burma where it is a comparatively recent introduction. One-third of the upland of the farm is being devoted to the crop, and every effort will be made to reduce the cost of cultivation and manuring to a minimum and to find the best varieties for varying local conditions.

A small quantity of an American fodder maize was grown. The plants grew very luxuriantly and it will be tried as a crop for silage.

A few seeds were sown of 'tepary' beans, a species of *phaseolus* indigenous to Central America and grown on a considerable scale by the Indians there before it was 'discovered' by the officials of the Tucson Experiment Station in Arizona.

The seeds were sown early in July and grew vigorously. Wet weather interfered with their ripening in September, but a fair number of seeds were harvested in that month and sown immediately. These did not grow very vigorously, but gave a fair yield in November, 2 seers being obtained altogether. The first sowing was clearly too early and the second too late. The season and habit of the plant seem to be the same as those of *kulthi* (dolichus biflorus), but commercially the crop is in a different class, and if it can be grown on a large scale might make a high price as 'haricots'.

The seed is being multiplied as fast as possible and single line cultures are being made of the most vigorous plants with a view to rapid acclimatisation.

A small quantity of 'Tall Russian' sunflower seed was sown in July: the plants grew to about 12 feet high but gave practically no seed. Probably like *sorguju* (niger) it would give a better yield of seed if sown later.

A few acres of *sannai* (crotalaria juncea) were sown to provide fodder for the cattle early in the rains before sufficient grass would be available. It is not so generally known as it might be that *sannai* makes an excellent fodder for this purpose. What is left over can be ploughed in and the land used for mustard or some other of the more valuable cold weather crops.

Small quantities of *jowar* and *guara* (cyamopsis psoralioides) were also sown mixed for fodder.

The growth was satisfactory, but it is doubtful whether the jowar can compete with maize for silage or with paddy straw as dry fodder where both can be grown, while the guara comes on at a season when there is usually plenty of grazing in Chota Nagpur, and it does not make good silage. On rich land an enormous bulk of the mixture can be grown and it may be useful for growing in gardens for autumn consumption for milch cows where extensive grazing is not available.

Dhaincha (sesbania aculeata) was sown for green manure on a paddy-field in April, 1916. The growth by the end of June was very poor—hardly equal to that of the weeds on other plots which had not been cultivated. Possibly it will do better if sown on the same field next year, as has been found to be the case in Madras.

Seeds of *tephrosia candida* and *tephrosia purpurea* (wild indigo) were sown in a belt along the road on the west of the farm. They are too slow growing to be of any use as green manures for ordinary crops, but *tephrosia candida* makes a good thicket for shelter on a bare hillside, and will grow on the poorest ground.

A small area of rape (*lotni*) was grown, and gave a good crop where it was manured with sulphur.

Manurial Experiments.

The accompanying table shows the scheme and results of the manurial experiments. * The crop grown on this area was groundnuts, which are sufficiently valuable to pay for a considerable expenditure on purchased manures.

The manures used were such as to supply those requirements of leguminous crops which were shown by analysis to be deficient in the soil, namely lime, (lime and gypsum), phosphoric acid (bonemeal) and sulphur (sulphur and gypsum).

The manures applied are shown on the left and the yields obtained on the right of each plot.

In estimating the results, the yield of each variant plot should be compared with half the sum of the yields of the standard plots on each side of it.

The irregularity of the results, in spite of the adoption of this method of discounting the effect of local variations in the soil, is due partly to the fact that the land was not even approximately uniform; but the following results are sufficiently marked to be significant:—

(1) The effect of the lime on the eastern series entirely masked the effect of the bonemeal.

(2) The effect of the lime on plots 1, 3, 9, 11 and 19 of the eastern series as compared with the adjoining unmanured plots was to increase the yield on the average by 664 lbs. per acre (but the lime cost about Rs. 40, an amount very little less than the increased value of the crop).

(3) The effect of the smaller quantities of lime in the middle series was relatively considerably greater than that of the larger quantities.

(4) The effect of the 4 maunds of bonemeal applied on plots 1, 3, 9, 11 and 19 of the middle series, as compared with the adjoining unmanured plots, was to increase the crop on the average by 440 lbs. per acre.

(5) The effect of the gypsum on plots 1, 3 and 9 of the western series as compared with the adjoining unmanured plots; and of the varying amounts of sulphur on plots 12, 14, 16 and 18 compared with plots 11, 13, 15, 17 and 19 which received the same manuring without sulphur, was to increase the crop very largely — 160 lbs. of gypsum giving an average increase of 693 lbs. of groundnut per acre.

* For a fuller discussion of these experiments see the Agricultural Journal of the Department of Agriculture, Bihar and Orissa, October, 1915 and October, 1916.

(6) The application of lime on plots 6 and 8 of the Western series in addition to the gypsum applied also to the adjoining plots, did not produce a very marked result in proportion to the amounts of lime applied.

The visible effect of the lime, sulphur, and gypsum on the crop was very remarkable; those plots that had received lime could be picked out immediately by eye and those that had received sulphur in addition, even in such a small quantity as 10lbs. per acre, could be picked out again by the greater luxuriance and changed colour of the crop.

The visible effect of the bonemeal was small, but phosphates primarily affect the yield of seed, and bonemeal commonly gives a better result in the year after application. (This effect is very obvious during the current season, 1916.)

In addition to these systematic experiments, lime and sulphur were applied on several fields on the farm. As previously mentioned, the lime produced a very marked effect on *rahar* and *urid*, growth being very luxuriant on the limed plots and very poor on those not limed.

Sulphur was applied at the rate of 20lbs. per acre to half of the rape (*lotni*) crop on the farm. The result was very marked on this crop also, the manured half was much more luxuriant, and remained in flower for fully a fortnight after the other half had finished flowering, and the yield of seed was very much greater. No exact comparison was possible because the land was not suited for a systematic experiment.

Cruciferous crops such as turnip, rape, and cabbage are known to require relatively large quantities of sulphur.

Recommendations.—The following practical deductions have been made from these experiments:—

1. The effect of sulphur applied in very small quantities to groundnut and rape on this soil is quite phenomenal, gypsum—which contains lime as well as sulphur—produces an extraordinary, immediate, and visible effect on groundnuts.

A maund of Bikaner *gypsum*, costing Re. 1·2 at Ranchi Station contains about 13½lbs. of *sulphur* and the equivalent of 34lbs. of *quicklime*—about enough of both substances to supply the annual requirements per acre of most crops. In practice it is probably better to apply larger quantities to leguminous and cruciferous crops whenever these crops occur in the rotation—quantities up to 40lbs. of sulphur per acre producing increased effects on groundnuts.

2. The cost of bonemeal at Rs. 3 per maund (80 lbs.), applied to groundnuts at the rate 328lbs. per acre, is recoverable in the first year; and as the effect is known to last for several years the manure is a sound investment. A maund of *bonemeal* per acre supplies enough *phosphoric acid* and *lime* for the actual annual requirements of most crops, but it is not all immediately available, and in practice it is probably better to apply 246 or 328 pounds at a time to the most paying crop in the rotation.

3. *Lime* has a great effect on most crops on this soil, but it is expensive, and having regard to the efficiency of gypsum and bonemeal—which, in the amounts necessary to supply the sulphur and phosphoric acid requirements of most crops, supply incidentally more than enough lime for the crop's actual consumption—it is doubtful whether the addition of lime to these manures will pay.

This doubt is confirmed by the results of the addition of lime to gypsum, on two plots on which it produced a relatively small additional effect.

Moreover the fact that the lime masked the effect of the bonemeal where both were applied, goes to show that one of the effects of the lime was to render available part of the very small reserve of phosphoric acid in the soil.

* There is however reason to believe that if large crops of groundnuts are to be grown for export with the asistance of gypsum, very much larger quantities of phosphoric acid will have to be applied to this soil than are provided in the quantity of bonemeal here suggested.

To some extent, lime is an exhausting manure, and its use alone on poor soils is to be deprecated for that reason.

On the other hand, in gardens or near towns where large quantities of organic manures are used, liming will probably be more effective and economical than gypsum and bonemeal. It can be safely applied once in, say, three years at the rate of 100 or 150 cubic feet per acre of slaked lime at the beginning of the monsoon.

In view of these deductions it has been concluded that an application of a mixture of 3 maunds of gypsum and 3 maunds of bonemeal per acre to groundnuts grown once in a 3 years' rotation, will probably be very economical (experience in Madras has shown that if this crop is grown more frequently the yield is seriously diminished).

These quantities will more than supply the draft on the soil's resources of lime and sulphur during the whole rotation, and the large amount of nitrogen provided by the groundnut crop residues, in addition to the small quantity supplied in the bonemeal is likely to provide amply for the requirements of a cereal crop in the following year. In the third year the land might either be manured—with cowdung if available—for another cereal crop, or another leguminous crop could be taken, manured with ashes, which are more commonly used in Chota Nagpur. There should thus be no difficulty in maintaining fertility under constant cropping—a practice which would admit of a very great extension of upland cultivation on the Plateau and would proportionately diminish the suffering occasioned by a partial failure of the paddy crop. The paddy-fields would probably also benefit very largely by the increased value of the washings from the upper land. It must be remembered in this connection that the value of the sulphur in the manures recommended lies not only in the direct effect of the very small quantity supplied, but to a very much greater extent in the indirect effect due to the very large amounts of nitrogen which this small quantity of sulphur enables to be accumulated. The proportion of nitrogen to sulphur in plants is commonly about 10 to 1.

Practical application.—In conformity with those recommendations extensive demonstrations have been started in the Ranchi District and experiments have been initiated at Purulia and Hazaribagh—46 maunds of groundnuts being supplied by the farm for these purposes.

The farm cropping is also being arranged on these principles ; one-third of the upland was sown with groundnuts before the end of the year under report—manured with lime and sulphur, as gypsum could not be procured in time at reasonable price.

For the future, arrangements have been made to obtain gypsum from Bikaner in 10-ton lots at the price mentioned above.

Disposal of produce.—The greater part of the farm produce was transferred to the Ranchi Jail at a book price satisfactory to both Departments. Milk was sold to the staff on the farm and to some of Messrs. Martin & Co.'s employès at the Asylum. Groundnuts to the value of Rs. 525 were sold locally.

The receipts for the year were Rs. 1,420.

The expenditure, including Rs. 1,981 spent on laying out and Rs. 609 on petty construction, was Rs. 10,786. This includes the greater part of the expenditure on cultivation for two years.

The great excess of expenditure over receipts was primarily due to the late start made, to ignorance of local conditions on the part of myself and the farm staff, to the initial poverty of the land, and to the necessity of buying food for the cattle, owing to lack of accumulated stocks.

Credit is due to M. Muhammadi Khan and Babu Bhutnath Sirkar, who have successively held the office of Farm Superintendent, for the energy with which the work of laying out and cultivation has been pushed on.

A. C. DOBBS,

Deputy Director of Agriculture,
Chota Nagpur Division, Ranchi.

Groundnut and Manurial Experiments.

	Eastern series.		Middle series.			Western series.	
—	Manure per acre.	Yield per acre, lbs.	Manure per acre.	Yield per acre, lbs.	—	Manure per acre.	Yield per acre lbs.
1	2	3	4	5	6	7	8
1	150 C′ Lime	2,820	320 lbs Bonemeal ...	2,480		160 lbs. Gypsum ...	3,680
2	No Manure	2,360	No Manure	1,700	2	No manure	2,520
3	150 C′ Lime	2,820	320lbs. Bonemeal ...	1,800	3	160 Gypsum	3,060
4	150 C′ Lime and 80lbs. Bonemeal.	2,640	320lbs. Bonemeal and 30 C′ Lime.	1,960	4	40 lbs. Sulphur ...	2,760
5	150 C′ Lime	2,580	320lbs. Bonemeal ...	2,040	5	160 lbs. Gypsum ...	2,730
6	150 C′ Lime and 160lbs. Bonemeal.	2,080	320lbs. Bonemeal and 60 C′ Lime.	2,440	6	160 lbs. Gypsum 30 C′ Lime.	2,580
7	150 C′ Lime	2,420	320 lbs. Bonemeal ...	2,000	7	160 lbs. Gypsum ...	2,280
8	150 C′ Lime and 240 lbs. Bonemeal.	2,440	320 lbs. Bonemeal and 90 C′ Lime.	2,480	8	160 lbs. Gypsum ... 210 C′ Lime	2,720
9	150 C′ Lime... ...	2,220	320lbs. Bonemeal ...	2,260	9	160 lbs. Gypsum ...	2,380
10	No Manure ...	1,640	No Manure	1,940	10	No manure	2,000
11	150 C′ Lime	1,720	320 lbs. Bonemeal	2,300	11	210 C′ Lime ... ... 560 lbs. Bonemeal	2,940
12	150 C′ Lime and 320 lbs. Bonemeal.	2,060	320lbs. Bonemeal and 120 C′ Lime.	2,660	12	210 C′ Lime ... ... 560 lbs. Bonemeal 10 ,, Sulphur	3,180
13	150 C′ Lime	2,000	320 lbs. Bonemeal ...	2,680	13	210 C′ Lime and ... 560 lbs. Bonemeal	2,900
14	150 C′ Lime and 400 lbs. Bonemeal.	2,160	320 lbs. Bonemeal and 150 C′ Lime.	3,180	14	210 C′ Lime ... ... 560 lbs. Bonemeal 20 ,, Sulphur	3,100
15	150 C′ Lime	2,260	320lbs. Bonemeal ...	2,620	15	210 C′ Lime ... ... 560 lbs. Bonemeal	2,420
16	150 C′ Lime and 480lbs. Bonemeal.	2,720	320 lbs. Bonemeal ... 180 C′ Lime	2,580	16	210 C′ Lime .. ... 560 lbs. Bonemeal 30 ,, Sulphur	3,220
17	150 C′ Lime	2,040	320 lbs. Bonemeal ...	1,980	17	210 C′ Lime ... ... 560 lbs. Bonemeal	2,560
18	150 C′ Lime and 560lbs. Bonemeal.	2,420	320 lbs. Bonemeal and 210 C′ Lime.	2,800	18	210 C′ Lime . ... 560 lbs. Bonemeal 40 ,, Sulphur	2,840
19	150 C′ Lime	2,300	320 lbs. Bonemeal ...	1,960	19	210 C′ Lime ... ... 560 lbs. Bonemeal	2,440
20	No manure	1,360	No manure	1,440	20	No Manure	1,340

Cart Road.

Cart Road.

No. 750, dated Sepaya (Saran), the 12th August 1916.

From—M. M. MACKENZIE, Esq., Superintendent, Sepaya Farm,

To—The Director of Agriculture, Bihar and Orissa, Ranchi.

With reference to your letter No. 5380—1R-25-16, dated the 7th July 1916, I have the honour to submit herewith a Detailed Report on the working of the Cattle-Breeding Farm at Sepaya for the year ending 30th June, 1916.

Annual Report on the working of the Sepaya Farm, Saran, during the year ending 30th June, 1916.

I.—CHARGE.

I held charge of the Farm throughout the year, with the exception of 11 days which was spent on privilege leave. Mr. Bama Shankar, Probationary Assistant Director of Agriculture, remained here during the whole year, except while absent on privilege leave for 12 days, and assisted me, while undergoing a course of training.

II.—AREA OF THE FARM.

The area of the Farm continued to be the same as last year, viz., 234·18 acres made up as follows :—

		Acres.
(*a*)	Under Cultivation	138·35
(*b*)	,, Grazing	70·00
(*c*)	,, Buildings, Roads, Banswarrie, etc.	25·83

The areas last year reported under sub-heads (*a*) and (*c*) have respectively decreased and increased by 5·62 acres, accounted for by the land taken up for new bungalow, garden and compound.

III.—FENCING OPERATIONS.

The fencing of the entire area of the Farm with "Ideal" Woven Wire was completed during the year ; ingress and egress being possible only through the gateways at various points. Unfortunately, owing to delay in completing the new roads referred to in paragraph 5 of my last year's report, which are being constructed by the District Board, it was impossible to exclude public traffic through the Farm. Now, however, I am glad to say that these roads are to all intents and purposes finished, and we shall set up our gates and keep the Farm area private. The Wooden Pile Bridge over the canal, also referred to in my last year's report as having been sanctioned, was completed and opened for traffic during the year.

IV.—CATTLE-BREEDING OPERATIONS.

At the opening of the year under report, the entire Breeding Herd consisted of 129 head—

(*a*) In the month of March last 28 Desi Cows with 17 calves at heel were purchased at Dumraon, Ballia and in the Ballia Doaba. The total cost including all expenses amounted to Rs. 2,169 or an average of Rs. 77-8-0 per cow. they were in poor condition when bought, but have now considerably improved, and will it is hoped produce desirable offspring of the type aimed at.

(*b*) Sixty-three calves were born during the year, 30 of which were males and 33 females ; of these 36 were sired by Stud Bull No. 49, 12 by Stud Bull No. 39 and 2 by Bull No. 35, 1 by Bull No. 37 and 1 by Bull No. 86, which last three bulls were sold to District Boards, and 1 calf was

born to cow, No. 181 which came from Sripur in a pregnant condition, and the remaining 10 calves were born of the newly-purchased cows.

(*c*) One very old cow of the Sripur lot, and 5 young calves (4 females and 1 male) varying in age from one to three months, died during the year. The causes of death among the calves were Hairball (3), Impaction of rumen (1) and diarrhœa (1).

(*d*) At the close of the year, the herd consisted of 231 head, viz., stud Bulls (2), Breeding Cows (91), two-year old calves :—males (7) females (9), one-year old calves :—Males (33) Females (19), Calves at heel :— Males (32), Females (38).

(*e*) The general health and condition of the Herd throughout the year was good, and there was no outbreak of any epidemic disease if a very mild form of Foot and Mouth which attacked 4 animals is excepted. The disease was promptly nipped in the bud by taking precautionary measures against its spread, and the attacked animals were none the worse for it. Owing to outbreaks, in the vicinity, of Black Quarter and Rinderpest, the precaution was taken to inoculate the Herd with Blacklegoids and Antirinderpest Serum.

(*f*) 113 general cases were treated on the Farm.

(*g*) Babu Mano Mohan Banarji, Veterinary Assistant, in addition to his farm duties, was in charge of the Gopalganj Subdivision from 9th February, 1915, to 16th March, 1916.

(*h*) Both our Stud Bulls are doing their work satisfactorily, Bull No. 49 having sired 36 calves (male 15 and female 21) and No. 39—12 calves (male 7 and female 5) while there are some 52 cows at present pregnant to both.

(*i*) Young stock are doing very well, and we should have some 8 young Bulls to dispose of during the coming year. We shall also have to dispose of the young female stock which we do not require for inclusion in the herd, but this matter will be separately represented a little later on for approval.

V.—Sale of Milk.

One hundred and fifty maunds, equivalent to 12,343lbs. of milk were disposed of to staff and outsiders during the year, and realized the sum of Rs. 488-4-11. This is about the same amount as was sold last year. The fact that some of the old cows which were brought from Sripur two years ago, not having sufficient milk of their own to satisfactorily rear their calves, which had to be supplied with milk from other cows, is accountable, in great measure, for no increase in the quantity of surplus milk available for sale.

Table A of the Appendix gives details of the sale of milk month by month.

VI.—Exhibition of Cattle and other Farm Products.

The following exhibits took prizes at the Tirhut Exhibition held at Muzaffarpur during February 1916 :—

(a) *Bihar-Bred Classes* :—

Stud Bull No 49	...	...	1st prize.
Cows Nos. 24 and 8	...	...	1st and 2nd prizes, respectively.
Heifers Nos. 11 and 24	...	...	1st and 2nd prizes.

(b) *Agricultural Products* :—

Sugarcanes (Saccharum officinarum)	...	...	1st and 2nd prizes.
Sann Hemp Fibre (Crotolaria juncea)	...	...	1st prize.
Oats (Avena sativa)	...	...	1st ,,
Tile-moulding apparatus	...	...	2nd ,,

VII.—Agricultural Herd.

During the year 5 Bullocks were purchased from the Ballia and Shahabad Districts. Two Bullocks died, one an old one purchased from the Maniara Concern two years ago, the other a good young animal died from "Impaction of Rumen". The total now stands at 46 head, all of which are giving useful work.

VIII.—Agricultural Operations.

A—*Experimental Canes planted during* 1916:—(*a*) The 53 varieties of sugarcane reported upon last year, were again planted out in an area of acres 4·88, in the month of February, 1916, each variety occupying $\frac{1}{10}$th acre in duplicate plots of $\frac{1}{20}$th acre each, with the exception of 11 varieties of which there was an insufficient quantity of seed for such an area. The names of these varieties with areas planted are given in Table B of the Appendix.

(*b*) *Imported Canes.*—The six varieties of imported canes which were received from Queensland in January, 1915, and which, all told, only furnished 168 setts then, were planted out in the month of March this year and have occupied an area of ·22 acre. These, at time of writing, are very promising and should later on provide a sufficient number of canes for a chemical test when ripe. The names or numbers of these canes are given in Table C of the Appendix.

(*c*) *Treatment of Canes.*—The entire area in which these 59 varieties of Experimental Canes, (*a*) and (*b*) above, are planted, was green-manured with San-Hemp, with the addition of Superphosphate at the rate of one maund per acre, and the land brought into thorough tilth prior to the canes being planted. There are, however, some patches of *Usar* soil in this area, and in these, the young canes failed to germinate satisfactorily. However, with six exceptions, no variety is so bad that there will not be sufficient to plant out a similar or larger area in the coming year.

(*d*) *Fencing of Experimental Area.*—The entire experimental plot has been surrounded with "Ideal" wire fencing. Generally speaking, all the Experimental canes with the exceptions mentioned above are doing well.

(*e*) *Disposal of Experimental Canes planted in* 1915.—Of the previous year's experimental plant canes the surplus after taking sufficient for this year's planting, amounting to 828 cwts., was disposed of as follows:—

	Cwts.
Sold to Raj Darbhanga	72
Fed to our cattle	756

Ratoons of these canes have been retained, and can either be sold to the public as seed, or used as fodder for our cattle.

(*f*) *Disposal of Experimental Canes planted in* 1914:—

	Cwts.
Fed to cattle	424
Sold to Raj Darbhanga	29
Supplied to Sabour Farm	8
Area, acres 2·21.	461

(*g*) *Arrowing of Canes.*—Six varieties of experimental canes flowered during the year, viz., Saretha, Chynia I, Kewali, Khari, Barukha and Khelia.

Specimens of all these flowers were sent to Dr. Barber, S., C.D., F.L.S., Government Sugarcane Expert at Coimbatore from time to time, who reported on the first consignment that the arrows of Saretha were only half emerged, and that the anthers were not protruded and that the arrows of Barukha were not protruded from the sheath, a character which he says was shown by this variety in the year 1914-15. No report was received from him

on the subsequent consignments of flowers sent to him, but it may be presumed that the condition of these was similar to those previously sent for inspection.

(*b*) *Analyses of canes with their names or numbers*:—During the month of February, 1916, 52 out of the 53 varieties referred to in sub-paragraph (*a*) above and which were planted in the previous year, were analysed for sugar content under the directions of Mr. Somers Taylor, the Government Agricultural Chemist, Sabour. The results of these analyses are embodied in the Table D of the Appendix.

B—Fodder Canes :—Planting of 1916.—During the year under report 12 acres were planted out in hemja canes, and the crop so far is a satisfactory one. As a test of germination, several methods of planting the setts were tried on a field scale—1st the ordinary method of cutting the canes into setts having three to four eyes or buds, 2nd, planting whole canes, 3rd, planting one eye or bud in a vertical as against the usual horizontal position. The first method has proved the most satisfactory, the second owing to crookedness of the canes, were difficult to plant and cover properly, and this proved a disadvantage so that the stand of canes is not so good as in the first method. The third I look upon as practically a failure.

Planting of 1915 .—26·69 acres of Hemja Cane planted out during the year 1915, was not a great success, as the entire area had been the previous year in *Juar*. However, owing to the dressing of 15 tons per acre of farmyard manure which it got before planting, we obtained an average weight of fodder per acre of 224 cwts., which may be considered satisfactory. 17·69 acres out of the above area have been retained as Ratoons, and will be cut probably in December 1916.

Planting of 1914 .—12·12 acres of Ratoons were harvested during the year under report, and yielded an average weight per acre of 205 cwts.

C—Other fodder crops :—(a) Judr (*Andropogon sorghum*).—During the year 1915, 41·10 acres were put under *Juar*, all of which was harvested during the year under report. About one acre failed entirely to germinate. The crop cut, yielded altogether 5,906 cwts. or an average of 147¼ cwts. per acre, of which 4,605 cwts. were fed fresh to cattle, the balance of 1,301 cwts. were pitted in one silo. This latter yielded 1,091 cwts. of good feed or 84 per cent. of the total pitted. During the year under report, in the months of May and June, 34·58 acres have been sown in *Juar*, and the crop at present is very promising. Farmyard manure at the rate of 81 cwts. per acre was applied to 22·20 acres of the above before sowing. The entire area, 34·58 acres, were under *Rabi* crops which were harvested in the month of March of the current year.

(*b*) *Teff Grass* .—Half an acre of land was sown in this grass as an experiment on 2nd June of the present year. It appears from an article recently published in the Quarterly Agricultural Journal of India, Volume XI, Part II for April 1916, that this grass has been experimented with on the Cawnpore Government Farm, and was found to do well when sown during the cold weather, but was not a success when sown during the monsoon. A small area, say half an acre, will be tried here during the coming cold weather.

(*c*) *Oats* (*Avena sativa*) .—46·14 acres were sown in this crop in the month of November 1915 to provide grain and bhusa for the cattle. Previous to sowing, the entire area had been green manured with sann-hemp in the previous August, and at time of sowing an application of superphosphate at the rate of 82lbs. per acre was given to 27·68 acres, while 16·58 acres were treated with Basic Phosphate at the rate of 164 lbs. per acre, 1·88 acres remained untreated with any fertilizers. The return in Grain and Bhusa from the entire area was as follows :—

Oats, 661·26 cwts. = 14·33 cwts. per acre.

Bhusa, 853·24 cwts. = 18·49 cwts. per acre.

With a view to testing the relative values, from a manurial stand-point of the two fertilizers, 2 plots marked A and B were set aside for the purpose.

Plot A of 18·66 acres was divided into two equal portions, one of which was treated with Superphosphate, the other with Basic Phosphate. The other plot B of 7·50 acres was also equally divided and similarly treated. The crops from both plots were harvested and threshed separately, a statement of the resulting produce is contained in the Table E of the Appendix. As was the case in the last year there does not seem to be much to choose between the two fertilizers. In one series the Superphosphate proved more efficient to the extent of 2·17 cwts. per acre of grain, and 2·3 cwts. of Bhusa, while in the 2nd series the Basic Phosphate was superior to the Superphosphate by 72lbs. per acre of grain, and 4·8 cwts. of Bhusa. From a monetary point of view the results work out as follows :—

Cost of Superphosphate per acre	Rs.	6	0 0
„ Basic Phosphate „	„	6	7 6

Plot A :—

	Rs.	a.	p.
Value of increased grain and Bhusa per acre in favour of Superphosphate.	10	6	6

Plot B :—

Value of increased grain and Bhusa per acre in favour of Basic Phosphate.	5	14	4
Less increased cost of manure per acre	0	7	6
Nett gain ...	5	6	10

On the two plots therefore the nett gain in favour of Superphosphate was Rs. 4-15-8 per acre.

(*d*) *Gram* (*Cicer arietinum*).—A plot of 1·50 acres of Kabuli gram, and one plot of Desi gram measuring ·50 acre were sown side by side. The Kabuli gram plot was sub-divided into two equal portions, one being treated before sowing with 82lbs. per acre of Superphosphate, the other with 164 bs. per acre of Basic Phosphate. The Desi gram plot was similarly sub-divided and treated. The outturns of both plots are shown in Table F of the Appendix. The return from the Kabuli gram plot was the same from both fertilizers, while in the Desi gram plot the Basic Phosphate gave an increase at the rate of 2·24 cwts. per acre. This increase, however, I should not attribute so much to the difference in the manures, as to difference in the soil, and no fair deduction as to the relative values of the manures can be made from such a small experiment. It will be repeated during the coming year.

(*e*) *Radishes* (*Raphanus sativus*).—1·50 acres were sown in this crop in the month of November 1915. The plot was sub-divided into two equal portions each having been treated with Superphosphate and Basic-Phosphate as in the case of gram [paragraph (*d*) above]. The Superphosphate plot yielded at the rate of 372 95 cwts. per acre, while the Basic Phosphate plot gave 386·88 cwts. per acre. So that from a manurial point of view the results had little to choose between them. The Table G of the Appendix gives particulars of the results.

D.—Crops other than Fodder.

One acre of land was sown in Sann-Hemp and one acre of *Patua* (Habiscus canabinus) both for fibre, and are doing well.

E.—Manuring of various kinds.

(*a*) Farmyard manure at varying rates, but averaging 5·78 tons per acre was applied on 33·80 acres of land and the following crops put in the land :—

1. Experimental Canes for 1916-17	4·88
2. Imported ditto	·22
3. Fodder ditto	2·00
4. *Jwar* for fodder	22·20
5. *Patua*	1·00
6. Sann-Hemp for green manure	3·50
Total acres ...	33·80

(*b*) *Superphosphate and Basic Phosphate.*—Details of the application of these have been given in sufficient detail when describing the different crops above—and results are contained in the Tables E, F, and G of the Appendix.

(*c*) *Green Manuring with Sann-Hemp* (*Crotolaria juncea*) *and Cowpea* (*Vigna catiang*).—47·11 acres of land in which there had been previously Cane and *Juar*, were sown in Sann-Hemp during the months of June and July, 1915 and the crop was ploughed under in the month of August, 1915. Details of the succeeding crops grown on these lands are given under their respective heads above. During the year under report, that is, in the month of June, 1916, 19·10 acres were sown in Sann-Hemp to be ploughed under in the month of August, 1916, for the succeeding *rabi* crops. Similarly an area of 19 99 acres was sown in Cowpea and will also be turned in for *rabi* during the month of August, 1916, for *rabi* next cold weather.

IX.—NEW BUILDINGS.

All buildings which at the time of submitting my last year's report were incomplete, were successfully completed during the early months of the year under report. The new Residential Bungalow was occupied on 28rd August, 1915 and is a comfortable and commodious dwelling.

The five new Cowstalls, for the erection of which during the financial year 1916-17 official sanction had been obtained, were taken in hand and had made good progress towards completion by the end of the year under report. The trough in connection with the new Cowstalls will be built after the rains have ceased, as I have received expert opinion to the effect that it will be inadvisable to lay the brick-on-edge flooring while the rains last.

X.—LAYING OUT.

(*a*) The following may be enumerated as some of the operations carried out under this head:—Dismantling the old Indigo Boiling and Press Houses, the old Carpenter's and Blacksmith's Shops, old Peon sheds, old Staff quarters, making 12,000 running feet of shallow surface drains in the Grazing area; cutting trees and jungle and cleaning out drainage channel along the Canal side of our Farm; surface repairs to roads and cleaning out the side ditches—straightening out and levelling edges of fields, care and repair of the Farm Protective Bund—filling up with earth carried from considerable distances, deep and wide ditches running parallel to our main Farm Road and reclaiming them for cultivation—filling deep and wide excavations on the side of our Grazing area, and north of same with earth carried from outside our Farm Bund, and adding the reclaimed area to our Paddocks and cultivated area respectively—raising the level of the field recently purchased from Phal Dusadh with earth taken from the spoil bank of the Sarau Canal; making, fitting and fixing gates for foot passage in several places in our wire fencing, not contemplated in our fencing scheme.

(*b*) *Mr. Howard's scheme of Drainage.*—In two selected areas Mr. Howard's scheme of drainage and prevention of soil denudation has been carried out by way of experiment. Altogether 5 drains have been made totalling about 4,038 running feet. The areas protected are 30·18 acres and 7·50 acres respectively. The drains are working quite satisfactorily, and it is hoped that they will be an improvement.

(*c*) *Water-Supply.*—During the months of April and May, the water-supply for washing down the cowstalls, for feed of our Portable Engine, and for building purposes, entirely gave out, and we had to excavate a small tank in the bed of the Nassi which usually furnishes the supply, at a cost of Rs. 42-8-0. The area excavated was 10,572 cubic feet, and the spoil earth was carried a considerable distance for filling up hollows near the cowstalls.

XI.—FLOOD OF THE GANDAK RIVER.

On the 12th and 13th August, 1915, there was a serious flood in the Gandak, the water of which rose to within about 2 feet of the top of our

Protective Bund. At one point at the north end of our Farm, there was a subsidence in our bund which fortunately happened in daylight and was at once detected. The gap formed was about 8 feet wide, but the inrush of water was staunched before any damage was done. Rat holes at various points were a source of danger, but those were all dealt with, and nothing untoward happened. A full report of the occurrence was submitted to the Director of Agriculture in my demi-official letter No. 722, dated the 8th September 1915.

XII.—DRAINAGE OF THE FARM.

All drains were properly maintained and attended to during the year, and did their duty satisfactorily. There was no flooding of any lands of the Farm such as was the case during the year 1914. The extra sluice gate erected in the Saran Embankment has proved itself most useful, and copes satisfactorily with all the drainage water in the Northern section of the Farm, which includes all our grazing lands.

XIII.—IMPLEMENTS AND MACHINERY.

Table H of the Appendix gives details of these at present in stock all of which are in good condition.

XIV.—WELL-BORING.

During the year the drinking well in Superintendent's garden was bored, and pipes were sunk to a depth of about 75 feet but without obtaining a supply of water. It was then decided to put in a $3\frac{1}{2}''$ convoluted tube, which has been purchased, and the necessary operations for fitting the same have been in progress during the last month or two. It is hoped that by inserting this tube the necessary supply of water will be obtained.

XV.—CHARITABLE DISPENSARY.

During the year correspondence took place with the Chairman, District Board, Saran, with regard to the provision of a Dispensary in the vicinity of the Farm, the nearest at present in existence being Gopalganj at a distance of $10\frac{1}{2}$ miles. The proposal of the Superintendent was approved, then there arose the question of a suitable site. The Public Works Department were then approached with a view to granting a site on the bank of the Saran Canal (which is being given up by the Public Works Department) and they readily consented to give the necessary ground. The next step in the proceedings was the approval of the site by a Site Committee composed of the Chairman, District Board, Saran, the Subdivisional Officer, Gopalganj and the officiating Civil Surgeon, Chapra, who met here on the 28th May 1916, and approved the site. But a difficulty has arisen as regards Funds, and it is doubtful whether the building will be sanctioned, at least while the present financial stringency continues. The Chairman, District Board, has been addressed again on the subject.

XVI.—VISITORS TO THE FARM.

The Superintendent, Civil Veterinary Department, Bihar and Orissa; Agricultural Chemist, Bihar and Orissa; Director of Agriculture, Bihar and Orissa; Superintending Engineer, Gandak Circle; Executive Engineer, Gandak Division; Assistant Engineer, Sewan Subdivision; Superintendent, Sabour Farm; Assistant Professor of Chemistry with 17 students of the Sabour Agricultural College; District Engineer, Saran; Deputy Director of Agriculture, Orissa Division; Magistrate of Saran; Subdivisional Officer, Gopalganj and Civil Surgeon, Saran, visited the Farm during the year.

XVII.—TOUR OF THE SUPERINTENDENT.

The Superintendent undertook the following tours during the year :—

19th to 25th November, 1915.	Sonepore—to purchase cattle.
27th to 29th February, 1916.	Mokameh—to meet Director of Agriculture.
6th to 14th February, 1916.	Pusa—to attend the meeting of the Board of Agriculture, and Muzaffarpur to attend meeting regarding the Saran Canals.
7th to 17th March, 1916.	Dumraon and Ballia—to purchase cattle.
22nd to 28th March, 1916.	Ballia—Doaba to purchase cattle.

XVIII.—RAINFALL.

The following is a statement of Rainfall for the year ending 30th June 1916 :—

	Inches.
July, 1915	10·73
August „	20·47
September „	8·98
October „	5·54
November „	·17
December „	·00
January, 1916	·00
February „	·73
March „	·00
April „	·10
May „	1·03
June „	8·87
Total ...	56·62

XIX.—RECEIPTS AND EXPENDITURE.

The following is an abstract of Receipts and Expenditure for the year ending 30th June 1916. Details are given in Table I of Appendix:—

	Rs. a. p.
Gross Receipts	1,500 10 3
Expenditure.	
Establishment	16,030 10 11
Travelling Allowance	449 3 6
Grain Compensation Allowance	160 13 6
Contingent Charges	23,536 13 3
Non-recurring Charges	8,196 15 3
Total ...	48,374 8 5

M. M. MACKENZIE,
Superintendent, Sepaya Farm.

TABLE A.

Statement showing the sales of milk during the year ending 30th June 1916.

Month.	Quantity of milk.	Value.	Remarks.
1	2	3	5
	lbs.	Rs. a. p.	
July, 1915	1,390	56 5 9	
August „	1 011	40 12 4	
September „	830	32 0 10	
October „	306	12 6 2	
November „	387	15 11 4	
December „	506	20 2 1	
January, 1916	619	24 0 0	
February, „	538	20 15 1	
March „	588	23 3 4	
April „	1,468	55 1 5	
May „	2,613	103 10 6	
June „	2,087	84 0 1	Deposited into Treasury in July, 1916.
Total ...	12,343	488 4 11	

TABLE B.

Statement showing the names and areas of experiment sugarcane planted during the year ending 30th June, 1916.

Serial No.	Name of canes.	Area of original plot.	Area of check plot.	Remarks.
1	2	3	4	5
		Acre.	Acre.	
1	Red Mauritius I	05	·05	
2	Red Java	·05	·05	
3	Red Tanna	·05	·05	
4	Kari	·05	·05	
5	Hemja	·05	·05	
6	Mungo	·05	·05	
7	Red Tanna	·05	·05	
8	Dhalsundar	·05	·05	
9	Sukli	·04	·036	
10	Keswar	·009	·004	

TABLE B—*contd.*

Serial No.	Name of canes.	Area of original plot.	Area of check plot.	Remarks.
1	2	3	4	5
		Acre.	Acre.	
11	Reora	·05	·05	
12	Pawara	·05	·05	
13	Chinia I	·05	·05	
14	Kewali	·027	·027	
15	Reora	·023	·031	
16	Red Mauritius II	·05	·05	
17	Kajla	·05	·05	
18	Khagri	·023	·027	
19	Chinia II	·027	·023	
20	Pareya	·05	·05	
21	Nargori	·05	·05	
22	Shaker Chinia	·05	·05	
23	Saretha	·05	·05	
24	White Tanna	·05	·05	
25	Puri	·05	·05	
26	Pansahi	·05	·05	
27	Lata	.05	·05	
28	Ketari I	·05	·05	
29	Baxaria	·05	·05	
30	Barukha	·05	·05	
31	Bombay	·036	·036	
32	Red Bombay	·014	·014	
33	Banaresia Nepali	·05	·05	
34	Yuba	·05	·05	
35	Bansa	·05	·05	
36	Maneria	·05	·05	
37	Striped Bansa	·05	·05	
38	Mungo	·05	·05	
39	Red Mauritius	·05	·05	
40	White Tanna	·05	·05	
41	Lawari	·05	·05	

TABLE B—concld.

Serial No.	Name of canes.	Area of original plot.	Area of check plot.	Remarks.
1	2	3	4	5
42	Khelia	Acre. ·05	Acre. ·05	
43	Maneria	·05	·05	
44	Khari	·05	·05	
45	Keswar	·05	·05	
46	Samsara	·009	·009	
47	Bhuri	·027	·014	
48	Ketari II	·05	·05	
49	Ketari III	·05	·05	
50	White Mauritius	·05	·05	
51	Juba	·05	·05	
52	Mutki Mungo	·05	·05	
53	Mungo	·027	·027	
	Passages on all sides	·085	·085	
	Total ...	2·447	2·433	

TABLE C.

Statement showing the names, numbers and areas of Imported canes planted during the year ending 30th June, 1916.

Serial No.	Name or number of canes.	Area of each plot.	Remarks.
1	2	3	4
1	No. 1 Rappoe	Acre. ·009	
2	„ 2	·004	
3	„ 3 D. 1135	·16	
4	„ 4	·032	
5	„ 5	·008	
6	„ 6	·007	
	Total ...	·22	

TABLE D.

Results of analyses obtained from Experimental sugar canes at Sepaya in February 1916.

Serial No.	Name of Varieties.	Sucrose.	Glucose.	Purity.	Juice.	Remarks.
1	2	3	4	5	6	7
1	Red Mauritious I	16·47	0·93	95·1	66·4	
2	White Mauritious I	15·62	0·68	92·3	71·3	
3	Red Mauritious II	17·80	0·64	96·8	70·3	
4	Red Tana I	15·71	0·63	91·1	61·8	
5	Saretha	17·9	0·30	93·7	61·4	
6	Mungo I	15·12	0·27	90 75	59·5	
7	Mutki mungo	16·31	?	91·7	59·3	
8	Buxaria	16·04	?	90·2	57·5	
9	Khari I	13·94	.	86·9	57·8	
10	Reora I	16·03	0·31	94·7	55·5	
11	Bombay	16·73	0·65	94 8	69 2	
12	Red Bombay	16·61	0·79	94·1	72·2	
13	Keswar	16·52	0·43	93·9	51·1	
14	Red Mauritious III	17·55	0·67	95 8	68·3	
15	Red Java	16·83	0·60	92·6	64.2	
16	Mungo II	17·47	0·33	95·1	48·8	
17	Juba	12·18	1·19	83·2	67·2	
18	Striped Bansa	15·61	0·67	88·5	66·4	
19	Barukha	13·75	0·75	84·8	60·3	
20	Kewali	12·21	0·91	81·4	63·8	
21	Ketari III	13·89	0·89	85·9	67 8	
22	Khelia	11·82	1·01	80·8	56·8	
23	Hemja	14·21	0·28	83·0	57·7	
24	Chinia I	11·07	0 95	77·	52·4	
25	White Mauritious II	16·11	0·60	93·1	69·5	
26	Shaker chinia	14·49	0·57	87·5	57·8	
27	Shamshera	16·7	0·73	92·9	71·4	
28	Ketari II	14·97	0·55	90·0	49·5	
29	Mungo III	17·29	0·24	93·7	55·1	
30	Nargori	12·77	1 13	82·0	69·4	
31	Manaria I	9·85	1·4	74·5	71·9	
32	Manaria II	12·07	1·23	82·9	67·5	
33	Ketari I	12·43	0·73	79·9	63·5	
34	Lewari	17·27	0·13	93·3	60·4	
35	Dhalsundar	14·22	1·16	87·7	62 6	
36	Kajla	11·23	1·86	77·7	59·0	

TABLE D—*continued.*

Serial No.	Name of Varieties.	Sucrose.	Glucose.	Purity.	Juice.	Remarks.
1	2	3	4	5	6	7
37	Khaori II	13·08	0·60	81·7	69·2	
38	Poraya	12·84	0·37	85·0	62·3	
39	Reora II	16·69	0·17	93·2	89·5	
40	Puri	11·2	1·93	75·8	62·7	
41	Bansa	12·91	0·85	84·7	59·4	
42	Lata	10 53	0·99	76·9	67·9	
43	Panshahi	14·1	0·66	88·6	69·1	
44	Banarasia Nepali	14·4	1·25	86·1	63·1	
45	White Tanna	16·33	0·53	92·9	70 7	
46	Sukli	10·88	1·80	74·3	72·8	
47	Red Tanna II	16·4	1·01	92·5	64·1	
48	Chinia II	12·19	1·23	82·1	66·6	
49	Bhuri	14·68	1·10	89·3	73·9	
50	Yuba	12·35	1·13	81·4	65·6	
51	Khagri	12·97	0·88	81·5	63·6	
52	Pawari	16·34	0·16	93·3	53·0	

TABLE E.

Statement showing the results of Experiments on Oats of Superphosphate *versus* Basicphosphate during the year ending 30th June 1916.

Serial No	Name of crop.	Plot No.	Area of each plot.	Manured with—	Outturn of grain per plot.	Outturn of grain per acre.	Outturn of Bhusa per plot.	Outturn of Bhusa per acre.	Remarks.
1	2	3	4	5	6	7	8	9	10
					C.wts.	C.wts.	C.wts.	C.wts.	
1	Oats ...	A	9·33	Superphosphate at 82 lbs. per acre.	140·64	15·06	169·85	18·19	
2	,, ...	...	9·33	Basicphosphate at 164 lbs. per acre.	120·42	12·89	148·52	15·88	
3	,, ...	B	3·75	Superphosphate at 82 lbs. per acre.	46·42	12· 4	44·47	11·87	
4	,, ...	..	3·75	Basicphosphate at 164 lbs. per acre.	48·83	13·01	58·2	16·65	

TABLE F.

Statement showing the results of Experiments on *Kabuli* and *Desi* gram of Superphosphate *versus* Basicphosphate during the year ending 30th June 1916.

Serial No.	Name of crop.	Plot No.	Area of each plot.	Manured with—	Outturn of grain of each plot.	Outturn of grain per acre.	Outturn of Bhusa.	Remarks.
1	2		4	5	6	7	8	9
					C.wts.	C.wts.	C.wts.	
1	Kabuli gram.	1C	·75	Superphosphate at 82 lbs. per acre.	4·01	5·34	7·23 from four plots.	
2	,,	2C	·75	Basicphosphate at 164 lbs. per acre.	4·00	5·32		
3	Desi gram.	1D	·25	Superphosphate at 82 lbs. per acre.	2·29	9 11	4·37 from four plots.	
4	,,	2D	·25	Basicphosphate at 164 lbs. per acre.	1·18	6·86		

TABLE G.

Statement showing the results of Experiments on Radishes of Superphosphate *versus* Basicphosphate during the year ending 30th June 1916.

Serial No.	Name of crop.	Plot No.	Area of each plot.	Manured with—	Outturn of each plot.	Outturn per acre.	Remarks.
1	2	3	4	5	6	7	8
					C. wts.	C.wts.	
1	Radishes	1E	·75	Superphosphate at 82 lbs. per acre ...	276·26	372·03	
2	,, ...	2E	·75	Basicphosphate at 164 lbs. per acre ...	286·54	386·84	

TABLE H.

Statement showing the details of Machinery and Implements in stock during the year ending 30th June 1916.

Serial No.	Names of Machineries and Implements.	Number	Remarks.
1	2	3	4
1	Tangye's Combined Pumping Engine and 6″ Centrifugal Pump with fittings.	1	
2	Carters Disintegrator or Surkhi Mill ...	1	
3	"Albion" Reaper	1	
4	Marshall and Sons Threshing Machine 54″ Drum with Elevator.	1	
5	Richmond and Chandler's Oil Cake Breaker ...	1	
6	Hand Colonial Lift and Force Pump ...	1	

TABLE H—*concld.*

Serial No.	Name of Machineries and Implements.	Number.	Remarks.
1	2	3	4
7	Rajah Ploughs	11	
8	Spring Tooth Harrow	6	
9	Two Ton Weigh-Bridge	1	
10	Horse Hoe	2	
11	Improved "Multiplex" Chaff-cutter Richmond and Chandler.	1	
12	Richmond and Chandler's Corn-crusher ...	1	
13	No. 10 Automatic Feed Baling Press ...	1	
14	Howard's D2 Ploughs	8	
15	Ridging and Sub-soiling Ploughs	2	
16	Rajah Lever Harrow (double)	1	
17	Portable Engine, Eight Horse Power, Messrs. Marshall Sons & Co.	1	
18	T. and F. Howard Sectional Roller 6′ × 20″ with Angle and Brackets.	1	
19	Hand Rotary Lift and Force Pump and pipes, etc., for water service.	1	
20	Meteor Rover Roadster Bicycle	1	
21	Surat carts	4	
22	Sampany	1	
23	W. I. Piping complete for water-service for cow stalls.	1 set.	

TABLE I.

Statement showing total Receipts and Expenditure during the year ending 30th June 1916.

Serial No.	Receipts.	Amount.	Remarks.	Expenditure.	Amount.	Total.	Remarks.
1	2	3	4	5	6	7	8
		Rs. a. p.		PARTICULARS.	Rs. a. p.	Rs. a. p.	
1	Sale of Bulls ...	400 0 0		I—Establishment :—			
				1. Salary of the Superintendent.	10,200 0 0	...	
2	Sale proceeds of Farm produce.	420 12 0					
				2. Salary of Staff	2,914 15 8	...	
3	Sale of Milk ...	485 0 9		3. Pay of Temporary Establishment.	2,915 11 3	16,030 10 11	
	Carried over ..	1,305 12 9		Carried over .	16,030 10 11	16,030 10 11	

TABLE I—*concld.*

Statement showing Receipts and Expenditure during the year ending 30th June 1916.

Serial No.	Receipts.	Amount.	Remarks.	Expenditure.	Amount.	Total.	Remarks.
1	2	3	4	5	6	7	8
		Rs. a. p.			Rs. a. p.	Rs. a. p.	
	Brought forward ...	1,305 12 9		Brought forward ...	16,030 10 11	16,030 10 11	
				PARTICULARS—*contd.*			
4	Prizes received from Tirhut Exhibition, Muzaffarpur.	17 0 0		II—Travelling allowance :—			
				1. Travelling allowance of Superintendent.	327 10 0	...	
5	Miscellaneous receipts	177 13 6					
				2. Travelling allowance of Staff.	121 9 6	449 3 6	
				III—Grain Compensation allowance.	160 13 6	160 13 6	
				IV—Contingent charges :—			
				1. Purchase of cattle	2,880 0 0	...	
				2. Feed of cattle ...	8,407 10 0	...	
				3. Purchase of seeds	763 15 6	...	
				4. Purchase of Manures.	1,196 10 0	...	
				5. Purchase of Implements.	323 14 3	...	
				6. Wages of Farm labourers :—			
				(*a*) For cultivation	3,257 3	...	
				(*b*) For laying out	768 14 0	...	
				7. Petty construction and repairs.	649 4 3	...	
				8. Railway and Steamer Freight.	460 6 6	...	
				9. Coolly and Cart hire.	192 10 0	...	
				10. Service postage and telegram charges.	125 1 0	...	
				11. Rent, rates and taxes.	2,146 14 0	...	
				12. Cold and hot weather charges.	92 4 9	...	
				13. Purchase and repair of furniture.	110 2 0	...	
				14. Office expenses ...	142 7 6	...	
				15. Miscellaneous Contingencies.	2,018 15 3	23,536 13 3	
				V—Non-recurring charges :—			
				1. Construction of buildings at Sepaya.	8,196 15 3	8,196 15 3	
	Grand Total ...	1,500 10 3		Grand Total ...	...	48,374 8 5	

M. M. MACKENZIE,

Superintendent Sepaya Farm.

No. 348, dated Sabour, the 28th July 1916.

From—C. SOMERS TAYLOR, Esq, B.A., Agricultural Chemist to the Government of Bihar and Orissa, Sabour E. I. R., (Loop),

To—The Director of Agriculture, Bihar and Orissa, Ranchi.

With reference to your letter No. $\frac{5257}{1R-24}$ dated the 4th July 1916, I have the honour to submit herewith the annual report of the Well-Boring Section for the year ending 30th June 1916.

Annual Report of the Well Boring Section for the year ending 30th June 1916.

At the beginning of the year the staff of this section consisted of one Superintendent, one clerk, two boring moharrirs, one mate officiating as moharrir and thirteen mates under training for the vacant posts of moharrir. In addition to these there were three apprentices sent for training by the District Board of Shahabad of whom two passed an examination held at the end of their training.

Of the 13 departmental mates under training seven resigned, three passed for the post of probationer and three remained as mates. It will then be seen that a good deal of energy has been spent on training suitable men for the post of moharrir. It is also evident that out of the applicants for the post very few are found to be finally suitable. One of our probationers has been lent to the District Board of Bhagalpur, under which he appears to have been doing satisfactory work.

During the year under review 34 borings were made as against 26 in the previous year. The number is still small and compares very unfavourably with those obtained in the Patna Division in previous years. The reasons are much the same as last year. In the first place the number of trained moharrirs is still small, owing to the unsuitability of the material on which we have to work in training. In the second place the depth to which borings have to be taken is much greater as a rule than in the Patna Division. Again the cost of casing pipe has gone up to such an extent that the price of wells has been increased and, in consequence, the cultivator thinks twice before applying for a boring.

In consequence of this, and other difficulties, it has been almost impossible to make out a definite programme for the year. The whole of the cost of each well with the exception of supervision and wear and tear of tools, has to be paid by the owner of the well. As a result the working power of our present staff, small as it is, is rendered still smaller by the fact that we have to await applications from owners before we can start boring. We have also been badly delayed by lack of coolies who are not available here for months during the rainy season. We have been also hampered by the fact that our field of operations has been on both sides of the Ganges and that much inconvenience and delay have been caused from time to time in transporting tools. The hill streams of South Bhagalpur have also sometimes prevented the moharrirs from shifting their apparatus as quickly as I should have liked.

From the annexed table 2 it will be seen that the Well-Boring Superintendent's energies were mostly concentrated in the part of Bhagalpur south of the river. In this country he was mostly occupied in the district south of Akbarnagar between Bhagalpur and Sultanganj and also in a group of wells south of Colgong. Experiments have also been made with the financial assistance of the Bhagalpur District Board to find the limits of the gravel bed from which Sabour takes its water-supply and which appears to be of singularly good quality. Attempts to locate it in the direction of Bhagalpur have failed, but the bed has been again discovered on the other side of Bhagalpur from Sabour and it is probable that it stretches round the edge of the low country south of Sabour and Bhagalpur which is flooded by the Chandan water in the rains. The wells which have been bored south of Sultanganj and Colgong are mainly used for drinking purposes and watering cattle, they do not appear to be much used for irrigation.

Experiments have been made with Musto's tool in the Santal Parganas at Godda. This boring was undertaken at the request of the Public Works Department but was abandoned after boring through 68 ft. of hard rock and finally coming to quartz.

In addition to the more or less systematic borings south of Sultanganj and Colgang borings have also been undertaken in Saran at the request of the Sanitary Engineer and also for Mr. Mackenzie at Sepaya. The first was an exploratory boring and the latter an experiment with a straining tube. The latter could not be finished owing to the non-arrival of screened sand sent from the south of the Ganges. Borings have also been done in Darbhanga, but the Superintendent reports that the supply of water was not very satisfactory as the original wells were not quite deep enough.

Only one boring has been made in Purnea, an experimental one with a $3\frac{1}{2}$ inch Brownlie's straining tube. Unfortunately, owing to the war, the owner of the well, the Hon'ble Raja Kirtyanand Sinha, has not been able to obtain a pumping engine of the type required, so that we have not been able to test this tube well. It is probable that strainer tubes will be the only type of tube wells suitable for the sandy tracts lying to the north of the Ganges, such as Purnea and North Bhagalpur, as there seems little evidence of thick bands of clay at moderate depths within that tract.

It is of interest to note that last year one of our old mates started a company with a set of tools of the same pattern as ours and bored 12 wells for cultivators of Dinapore and Patna City. His work is not progressing well at present, owing to the enormously enhanced price of casing pipe, which as I have already mentioned has also hampered our own work considerably.

This is, I am afraid, likely to produce still more difficulty in the future. Up to quite lately the Department had a large stock of casing pipe bought at the old prices, but it has recently had to raise the standard price per foot. Further, the Well-Boring Superintendent reports that there seems little demand for boring among the actual cultivators in these districts unlike the case in Patna, Shahabad and Gaya. There is no doubt that this is, due to the extra expense involved in boring in Bhagalpur Division, as compared with that in the Patna Division.

C. S. TAYLOR,

Agricultural Chemist,

Bihar and Orissa.

No. 1.

Statement showing number and location of wells bored during the year 1915-16.

Serial No.	Location.				Name of owner.	Diameter of well.	Depth of well below G. L.	Depth of boring below G. L.	Surface of water below G. L.	Length of casing pipe.	Remarks.
	District.	Subdivision.	Thana.	Village.							
1	2	3	4	5	6	7	8	9	10	11	12
						Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	
1	Saran ...	Siwan ...	Gopalganj ...	Sepaya ...	Government Farm ...	5 2	16 0	86 0	9 0	...	.....
2	Monghyr ...	Jamui ...	Shaikhpura ...	Shaikhpua ...	Excise Ware house ...	6 0	32 6	103 6	21 6	61 0	Successful.
3	Darbhanga ...	Madhubani ...	Madhubani ...	Rampatti ...	Mahanth Sahdev Das...	6 10	22 6	102 6	10 6	62 8	Feeble supply obtained.
4	Bhagalpur ...	Banka ...	Amarpur ...	Kharahra ...	.....	...	...	100 4	...	...	Trial boring with Sukul's Tool.
5	Darbhanga ...	Madhubani ...	Madhubani ...	Rampatti ...	Mahanth Sahdev Das	10 0	27 6	133 6	18 0	62 8	Successful.
6	Bhagalpur ...	Sadr ...	Mufassil ...	Fatehpur ...	.....	8 7	40 6	221 6	32 0	...	Successful. Pipes pulled out as it was bored for finding out the quality and thickness of saturated sand.
7	Darbhanga ...	Madhubani ...	Madhubani ...	Rampatti ...	Ram Birich Ram ...	6 9	26 0	106 0	13 0	64 0	Successful.
8	Ditto ...	Sadr ...	Darbhanga ...	Darbhanga ...	Damri Sao Thakur Rai	...	...	92 0	...	...	Trial boring. Feeble supply obtained.
9	Ditto ...	Do. ...	Ditto ...	Ditto ...	Ditto	9 0	36 0	82 0	10 0	67 0	Successful.
10	Monghyr ...	Jamui ...	Shaikhpura ...	Bazidpur ...	M. Fazal Haque ...	3 0	36 0	82 0	29 0	...	Ditto.
11	Darbhanga ...	Sadr ...	Darbhanga ...	Misirtoli ...	Babu Sadhur Misir ...	3 9	23 0	88 0	17 0	...	Unsuccessful on account of thick bed of sand.
12	Monghyr ...	Jamui ...	Shaikhpura ...	Bazidpur ...	M. Altaf Hossain ...	3 8	27 0	86 0	23 0	...	Work stopped as owner did not supply coolies regularly.
13	Ditto ...	Do. ...	Ditto ...	Ditto ...	Sh. Ramzan Mokhtar	6 0	22 0	128 0	14 0	...	Successful. Pipes pulled out as the supply was feeble.
14	Bhagalpur ...	Sadr ...	Nathnagar ...	Bhathauria ...	District Board ...	...	...	134 0	13 0	132 0	Trial boring in 6 ft. pit.
15	Ditto ...	Madhipura ...	Madhipura ...	Sahugarh ...	Manager, Sonbarsa ...	...	...	36 0	6 6	36 0	Ditto.
16	Ditto ...	Ditto ...	Sultanganj ...	Katahra ...	Darbhangi Mandor ...	5 0	29 0	143 0	19 0	6 0	Feeble supply was obtained.
17	Ditto ...	Ditto ...	Ditto ...	Kapsauna ...	Tulsi Mandor ...	6 4	26 0	44 0	10 0	16 0	Successful.
18	Ditto ...	Ditto ...	Ditto ...	Ditto ...	Masudan Mander ...	5 0	30 0	50 0	18 0	10 0	Ditto.
19	Darbhanga ...	Sadr ...	Darbhanga ...	Ladha ...	Bhairo Mahto ...	5 6	27 0	97 0	16 0	65 0	Ditto.
20	Bhagalpur ...	Do. ...	Sultanganj ...	Shazadpur ...	Babu Jai Karam Singh	7 0	28 0	52 0	10 0	20 0	Ditto.
21	Ditto ...	Do. ...	Ditto ...	Ditto ...	Babu Chandra Mohan Singh.	5 0	15 0	55 0	9 0	20 0	Ditto.
22	Dumka ...	Godda ...	Godda ...	Godda ...	Public Works Department.	4 2	43 6	111 6	36 6	16 0	Work stopped on coming in contact with quartz after boring through 68 ft. of hard rock.
23	Do. ...	Do. ...	Do. ...	Lahtiya ...	Babu Kishori Mohan	...	...	67 0	28 0	45 0	Trial boring.
24	Bhaglapur ...	Sadr ...	Shakund ...	Pachkothia ...	Munshi Naurangi Lal	7 0	22 0	72 0	14 0	20 0	Successful.
25	Ditto ...	Do. ...	Ditto ...	Banawan ...	Tiloki Singh ...	5 0	16 0	51 0	9 0	20 0	Ditto.
26	Ditto ...	Do. ...	Colgong ...	Ghasi a w a n Chak.	Babu Dwarka Prashad	7 0	37 6	73 6	29 6	18 0	Ditto.
27	Ditto ...	Do. ...	Ditto ...	Ditto ...	Jib Lal Mander ...	3 10	27 6	72 6	24 6	...	The work was abandoned by the owner.
28	Ditto ...	Do. ...	Ditto ...	Ditto ...	Babu Dwarka Prashad	3 10	27 0	65 0	19 6	18 0	Successful.
29	Ditto ...	Do. ...	Shakund ...	Pachkothia ...	Dukhi Bhagat ...	7 0	12 0	62 0	8 0	..	Left incomplete and pipe pulled out as owner refused to pay the cost of further boring.
30	Ditto ...	Do. ...	Colgong ...	Ahero ...	Manager, Tilakdhari Singh.	8 3	30 0	64 0	21 0	9 0	Successful.
31	Ditto ...	Do. ...	Ditto ...	Do. ...	Ditto	5 7	48 7	78 7	37 1	9 0	Ditto.
32	Ditto ...	Do. ...	Ditto ...	Do. ...	Hussaini Mia ...	4 5	46 0	80 0	31 0	18 0	Ditto.
33	Ditto ...	Do. ...	Ditto ...	Do. ...	Ismul Haji ...	4 6	43 0	85 0	30 6	22 0	Ditto.
34	Purnea ...	Purnea ...	Purnea ...	Deorhi Champanagar.	Hon'ble Raja Kiriyanand Sinha.	...	...	1	...	...	Tube well with Brownlie's Strainer.

No. 2.

Abstract statement of wells bored during the year ending 30th June 1916.

District.	Sub-Division.	Depth of well.			Depth of boring.			Depth of bottom of boring.			Greatest depth bored.	Least depth bored.	Greatest depth to the bottom of boring.	Least depth to the bottom of boring.	Remarks.
		No. of wells.	Total depth.	Average depth.	No. of wells.	Total depth bored.	Average depth bored.	No. of wells.	Total depth.	Average depth.					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
			Ft. In.	Ft. In.		Ft. In.	Ft. In.		Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	
Bhagalpur ...	Sadr ...	16	478 1	29 10	17	928 0	54 7	17	1,406 0	82 8	181 0	18 0	221 0	44 0	One trial boring.
	Banka ...	...	...	...	1	...	100 4	1	...	100 4	100 4	100 4	100 4	100 4	Ditto.
	Madhipura	...	...	...	1	...	36 0	1	...	36 0	36 0	36 0	36 0	36 0	Ditto.
Dumka ...	Godda ...	1	43 6	43 6	2	125 0	62 6	2	168 6	84 3	68 0	57 0	111 6	57 0	Ditto.
Saran ...	Siwan ...	1	...	16 0	1	...	70 0	1	...	66 0	70 0	70 0	86 0	86 0	
Monghyr ...	Jamui ...	4	117 6	29 4	4	282 0	70 6	4	399 6	99 10	106 0	46 0	128 0	82 0	
Darbhanga...	Sadr ...	3	86 0	28 8	4	273 0	68 3	4	359 0	89 9	92 0	46 0	97 0	82 0	Ditto.
	Madhubani	3	76 0	25 4	3	266 0	88 8	3	342 0	114 0	106 0	80 0	133 0	102 6	
Purnea ...	Purnea ...	...	...	...	1	...	60 0	1	...	60 1	60 0	60 0	60 0	60 0	Tube well with Brownlie's Strainer.

No. 840, dated Calcutta, the 19th July 1916.

From—T. SOUTHWELL, Esq., A.R.C.S, F.Z.S., Deputy Director of Fisheries, Bengal and Bihar and Orissa,

To—The Director of Agriculture, Bihar and Orissa.

In reply to your letter No. 5256-1 R-24 of 16, dated the 4th July 1916, I have the honour to submit herewith a report on the work undertaken by the Department during the year ended June 30, 1916.

As usual, this report summarises the work attempted both in Bengal and Bihar and Orissa, and a copy has, therefore, been sent to the Director of Agriculture in each province.

Under the Directors of Agriculture, I was in charge of the Department throughout the year, and was assisted by Mr. B. Das, M. A., and Mr. S. M. Mohsin, Superintendents of Fisheries. The temporary appointment of Zoological Assistant was held throughout the year by Babu Surendra Nath Ghosh. The question of confirming this officer in his appointment has been considered by Government. He will be confirmed and placed in class I of the Subordinate Agricultural Service on passing a Zoological Examination equivalent to that of the Medical College, Calcutta.

In former years I summarised, in my annual report, the work done by the two Superintendents of Fisheries. This year I submit direct the annual reports prepared by these officers.

The Deputy Director of Fisheries joined the Department on December 5, 1911. The agreement drawn up by the Secretary of State was for two years in the first place, extendable to four years. This agreement expired on December 5, 1915. In September 1915 representations were made by the two Local Governments to the Secretary of State, through the Government of India for confirming the present Deputy Director in his appointment. Pending a reply from the Secretary of State the Deputy Director carried on the work from December to the end of June under the orders of the local Government. The unsettled future of the Department, and of the Deputy Director in particular, during the year under review, has seriously interfered with the work of the Department, as I deemed it inadvisable to incur expenditure on hatcheries etc., until I was certain that they could be utilised when constructed. I was also unable to take over the administration of certain fisheries, and the work suffered in other ways.

Tours.—I was away from Calcutta on tour for 116 days.

Fishery surveys were made at Bandel, Serampur, Mankundu, Ranaghat. (Churni river), Naihati, Siliguri, Shamnagar, Amta, Tarkeswar, Ranigunj, Burdwan (Damodar river), Sasaram (Canals), Sambalpur, Gaya and Purulia.

Work in the Launch was confined to the Khulna area, which was visited several times, particularly during the Hilsa season. The Attarabanka and Bhairab rivers were carefully investigated. During the Hilsa operations conducted by Mr. Mohsin at Buxar, I visited this station on three occasions. I visited Cuttack four times, partly to supervise the work done there by Mr. Das on Carp and Hilsa, partly to arrange details regarding the erection of fish pass over the Mahanady, and partly to initiate propaganda work amongst the fishermen with the object of forming a Co-operative Fishery Society. I visited Ranchi on two occasions; once to discuss general fishery matters with the Director of Agriculture, and again to discuss certain proposed fishery regulations with the Hon'ble Mr. F. Clayton, Secretary to the Government of Bihar and Orissa, Public Works Department (Irrigation, Marine and Railway Branches). I visited Jangipur, Berhampur and Krishnagar (the latter on two occasions) in order to initiate Co-operative Credit Societies amongst fishermen. Twice I went to Arrah to arrange details with the Superintending Engineer relating to the proposed Carp tanks at Delabagh. On two occasions I visited Puri in order to make observations on the breeding habits of Pomfrets and Mullets. Investigations were made at Amta and Bankipur with reference to the occurrence of Carp eggs and fry. I visited Dacca

in order to enquire (1) what improvements are possible in the pearl-button industry, (2) whether free schools could be established amongst the poorer fishermen, (3) to enquire into the desirability of fixing a central fish market.

During February I attended the meeting of the Board of Agriculture at Pusa, and in December last, at the request of the Director of Fisheries, Punjab, I inspected the fishery operations which are being conducted by the Punjab Government.

Reports on my investigations at every place named have been sent to the Director of Agriculture of each Province, as have also the reports of the two Superintendents of Fisheries.

Babu Surendra Nath Ghosh, the Zoological Assistant, was on tour for 200 days. He visited Amta, Champadanga, Hooghly, Chinsurah, Chandernagar and Serampur in connection with the work of Carp—fry distribution.

General fishery survey were made by him at Bandel, Kustea, Midnapur, Khargpur, Uluberia, Purulia, Bankipur and Puri.

He enquired into the relations existing between the fishermen and Zemindars at Bhagalpur, Monghyr and Champanagar. He assisted in conducting fishery enquiries in the Launch between Khulna and Barisal, stopping at the following refishery centres:—Khulna, Jhalakati, Alaipur, Manickdah, Fathgate, Tarkeswar, Kowkhali and Barisal. He assisted in the Hilsa investigations at Cuttack, Kujong, Buxar and Goalundo. He attended the Agricultural Exhibitions and had charge of the fishery exhibits at Khagra (Purnea), Sambalpur and Banjetia (Murshidabad). He was deputed for one month to work under the Registrar of Co-operative Societies, Bengal, in order to prepare himself for undertaking the establishment of societies amongst fishermen, where, and when, such a course seems desirable. During this period, and subsequently, he visited the following places purely in connection with co-operative work :—Jangipur, Pabna, Dacca, Chandina, Munshigunj, Pura (Dacca District); Khelar, Arun, Khagra, Bhadrakali, Dhitpur, Markandachak, Ilaspur, Kesherpur, Simulia, Monoharpur, Hariharpur, Mughberia, Bajarpur, Baruipur and Sankarpur (Midnapur District); Brahmanberia, Golkar and Gokaran (Tippera District).

On a report made by Babu Surendra Nath Ghosh to the effect that Carp bred regularly in a Bundh at Jogardanga near Garbetta (Midnapur District), we instituted enquiries which ultimately established the truth of his report, as a result of which we have been able to collect most valuable information regarding the breeding habits of Carp, certain details of which are given later in this report.

During July and August Babu Surendra Nath had, practically, entire charge of the work of distributing Carp fry throughout both Provinces, which he carried out in a satisfactory manner. Under my guidance he published a report, in Bengali, on the "Carp Fry Industry in Bengal", and he also assisted me in the preparation of maps illustrating the report on "Fishery rights in Bengal and Bihar and Orissa".

Publications.—During the year under consideration the following papers have been prepared and published :—

1. "Certain facts relating to the fisheries in Bengal, and Bihar and Orissa", published in the Agricultural Journal of the Department of Agriculture, Bihar and Orissa, Vol. III. No. I, April 1915. (Was not available until October 1915.)
2. A Bengali translation of a paper on "Some local industries dependent on Acquatic animals", published as Departmental Record, No. 4.
3. "On some Indian Cestoda", Part II, published in the Records of the Indian Museum. Vol. XII., Part I, No. 2, February 1916.
4. Statistics of fish imported into Calcutta during the year ended 31st March 1916, which have been collected by the Director of Statistics

in accordance with the order of the Government of Bengal, but which have been published as Bulletin No. 9 in order to continue our series, the present being the fourth in the series.

The following papers, which were in course of preparation during the preceding year, have also since been completed and published :—

5. A paper describing a large number of fish-diseases published in the Records of the Indian Museum, Vol. XI. Part IV, August 1915, as " Notes from the Bengal Fisheries Laboratory ", No. 2.
6. A report on " Parasites from fish and Acquatic birds in the Chilka Lake ", published in the Records of the Indian Museum, Vol. XI. Part IV, August 1915, as " Notes from the Bengal Fisheries Laboratory ", No. 3.
7. A report dealing with the Fishery Rights in the estuaries and rivers of both Provinces ; illustrated with maps.
8. A report, in Bengali, of the work done by this Department during the year ended June 30th, 1914, published in the " Krishi-Samachar ". Translated by Mr. Das.
9. A brochure, in Bengali, on " The Carp-fry industry in Bengal " published as Departmental Record No. 3, by Babu Surendra Nath Ghosh.

Besides the above, a comprehensive work on the life-histories and habits of Carp, and other common edible fish in Bengal, has been commenced.

Laboratory work.—Unfortunately, owing to pressure of other work , it has not been found possible to devote much time to research. This is the more disappointing on account of the fact that the real development of the fisheries of this province depends almost wholly on scientific research. The Department (whose operation extend over two Provinces) is lamentably understaffed. Whilst we are fully aware of the lines on which progress could be made, we were unable to do justice even to most important aspects of our work. Thus, although we have been fortunate in working out fully and accurately the life-histories of Indian Carp, and also of *Notopterus chitala*, the series of embryonic forms deposited in the Fisheries Laboratory in the Indian Museum, still await description. During the year before us we propose making a special feature of research work, as we consider this essential. The actual investigations undertaken are summarised in the publications Nos. 3, 5 and 6 noted above and need not be detailed here. In addition, the nature of various diseases prevalent amongst marketable fish was determined for certain Municipal Health Officers.

Propaganda work.—As usual, propaganda work has been continued vigorously on the lines adopted in previous years. We have ample proof that our endeavours have been far from fruitless. It is clearly desirable that we should seek to get into intimate touch with the actual fishermen, for only by so doing can we hope to achieve the best results.

Agricultural Exhibitions.—The Department attended and had exhibits at the following places :—

Banjetia (Bengal) ; Purnea, Monghyr, Khagra, Ranchi, Tirhut and Sambalpur (Bihar and Orissa).

Under orders from Director of Agriculture, Bengal, no exhibitions were attended in Bengal, with the exception of the Banjetia Exhibition in Berhampur where at the special request of the Maharaja of Cossimbazar we sent fishery exhibits. The exhibits were similar to those of the preceding years and everywhere aroused the interest of the public.

Hilsa culture (*clupea elisha*).—We had one Hilsa station at Cuttack and another at Buxar. Mr. Das was in charge of the former and Mr. Mohsin of the latter. I fixed on Cuttack because the anicut over the Mahanadi prevents Hilsa from migrating further up the river. The fish collect at the foot of the anicut, and fishermen are plentiful. We thus had a plentiful supply of fish. The first Hilsa was obtained on June 15th. The eggs measured ·08 mm. Hilsa

increased in numbers as the season advanced, and the eggs increased in size. On October 28th the eggs measured 1·02 mm. in diameter, and the fish were evidently ripening. The day following the authorities of the Public Works Department found it necessary, for the safety of the anicut, to close the sluices, thus diverting the main current into the Biropa river. The Hilsa disappeared at once. Messrs. Das and Ghosh then followed the fish down to Kujang (50 miles) but on their arrival were unable to obtain fishermen to catch fish. On the 29th November a consignment of Hilsa caught near the mouth of the Mahanadi was examined and found to be spent. It seems clear that some success would have been achieved could our investigations at Cuttack have continued. As it was, we were compelled to cease operations at the critical moment. I consulted the Superintending Engineer with a view to keeping the sluices open a little longer, and I am satisfied that, had it been possible, this would have been done.

At Buxar no results of any kind were obtained. Usually, hundreds of Hilsa are available daily at this place, but during the year under review the Hilsa season at Buxar was a failure. The total number of fish examined by Mr. Mohsin during July, August, September and October amounted only to 252. It will be remembered that three years ago no ripe Hilsa were obtainable at Monghyr. Mr. Mohsin was of opinion that at Buxar, which is about 140 miles higher up the river, ripe Hilsa would be available. As we have seen, the result was disappointing. At Khulna, Babu Surendra Nath Ghosh, examined 185 Hilsa in early October. Of these, 119 were immature females and 18 were partly mature females. Of 48 males, one was fully mature, 13 partly mature, and 34 immature. In addition, Babu Surendra Nath examined numbers of Hilsa at Goalundo, none of which were ripe. I confined my investigation to the Attarabanka and Bhairab rivers in the Khulna District. The work was conducted in the Launch. Whereas in other parts of the province, Hilsa are caught one at a time, (by means of Sangla jals), in the Khulna District huge nets are used. As a result I had the opportunity of examining large numbers of Hilsa continuously until the season was entirely over. Although mature Hilsa (both male and female) have been repeatedly found, we have never yet been able to obtain mature specimens of both sexes at the same time. All the evidence points to the probability of Hilsa breeding during their actual ascent up the rivers. No one has yet seen them breeding. It is useless to fix hatcheries on shore merely because Hilsa are abundant at that particular place. Apparently what is necessary is that the Hilsa have to be carefully followed up the river from, say Goalundo, or up the Ganges, until the ripe sexes are discovered. This we are attempting to do. The elucidation of the habits particulary the breeding habits of Hilsa is by no means a simple matter. Similar work in America, and elsewhere, has only been accomplished as a result of prolonged and careful observtions by numbers of trained men. Our information regarding the habits of Hilsa is materially increasing year by year, but it is not likely that we shall be in a position to artificially cultivate this species for some time yet.

Enquiries into the habits of other fish.— The life history and breeding habits of *Notopterus chitala*, and of other species nearly related to it, have been worked out fully. Unfortunately, up to the present we have been not able to write up the account and figure the details, but this we shall do as early as possible. As yet, we have been too fully occupied to take up direct investigations into the breeding habits, etc., of Bhekti, *Lates calcarifer* Topsi *Polynemus paradiscus* etc., as these fish breed almost at the same time as Carp and certain *Siluridæ*, on which we have up to the present confined our obsservation.

Enquiries into the habits of Indian Carp.— These enquiries have been most successful. We have been fortunate in being able to discover Carp in the act of breeding. This took place in the Talbandi, at Jagardanga, near Garbetta, district Midnapur. It appears that carp regularly breed in this Bundh as they also do in neighbouring Bundhs. Breeding takes place in very shallow water (about one foot), at the very onset of the rains. We were successful in securing a fine series of embryos. In Europe the development

of Carp eggs occupies several days, depending largely on temperature. In Bengal, the eggs hatch out in about 24 hours. During enquiries which I made into the Carp fisheries in the river Damodar at Amta, Tarkeswar Burdwan and Raneegunj, last cold weather, the conclusion was arrived at, that a favourite breeding place for Carp is in the beels. These beels are connected with the rivers during the rains. The place chosen by Carp comprises the shallow part of the beel which is dry land during the hot weather. During the floods, the fry are carried from the beels into the rivers. It appears certain, however, that Carp also breed in the rivers, but as yet no special breeding grounds have been located. The discoveries made with reference to the breeding habits of Carp are of the highest importance, since we are now in a position to supply large quantities of pure fry to the public. During the year, Government has sanctioned the construction of experimental Carp-tanks at Delabagh on the Dehri-Arrah canal. This site was chosen because running water is available in quantity throughout the year. The estimated cost is Rs. 4,000 and the work will be completed before March 31st, 1917. These tanks will resemble the natural Bundhs in Bengal in which Carp breed naturally, and we have every reason to expect that Carp will breed in them. In addition, methods of artificially cultivating them will be studied, and, if possible, perfected. The reclamation of these beels (in progress throughout Bengal) is a serious matter because in the process, the breeding places of the principal fish of the Province are destroyed.

Now that we have determined the conditions under which Carp will breed, endeavours will be made to simulate these conditions in other water-areas throughout the Province. Such operations seem to me to be full of promise.

Cultivation of fish in tanks and Distribution of fry .—We have this year received orders for 4½ lakhs (450,000) of Carp fry. These we shall distribute, for cultivation in tanks, before the end of August 1916. During the earlier part of the year, circulars were distributed throughout both Provinces advising people interested that orders for fry could be booked. The principal railways have, as usual, granted special facilities for the transit of these fry. The manner in which this industry has grown can be judged by the following figures :—

Distributed in	No. of fry.
1913	132,000
1914	209,000
1915	261,000
Ordered up to 30th June for	
1916	450,000

Up to the present, we have not been able to supply pure Carp fry. A certain percentage of predatory fish were present in nearly all the consignments hitherto sent out. As a result of our carp investigations during the year under review, we are now in a position to supply a considerable quantity of pure Carp fry, and this quantity will increase yearly. The ultimate effect on the cultivation of fish in tanks will undoubtedly be markedly beneficial.

Marine and Estuarine fisheries .—No opportunity occurred during the year for undertaking any marine work. A few Calcutta Firms made inquiries regarding the possibility of initiating a fish-oil and manure business along the Orissa coast, and in the vicinity of the Chilka Lake. Details were discussed with the Firms' representatives and advice given.

The investigations into the estuarine fisheries were limited again to the Khulna District. The fisheries in the Bhairab and Attarabanka rivers were specially investigated. The work dealt mainly with the beel and Hilsa fisheries, and with the possibility of establishing Co-operative Fishery Societies. Practically every fishing village between Khulna and Barisal was inspected, and the prospects of co-operative work amongst these fishermen are most promising.

Unfortunately we were not able to continue our enquiries into the Chilka Lake fisheries.

Fish Traffic.—Under orders from the Government of Bengal (letter No. 9466, dated the 29th August 1915) the work of collecting fishery statistics was relegated to the Director of Statistics. His report for the year ended March 31st, 1916, has been published by this Department in order to keep our series continuous. It appears from the report in question that the total imports of fish to Calcutta, *via* all routes amounted approximately to 240,143 maunds or 8,821 tons, as against the following figures for the three preceding years, which, it should be noted, *do not include fish imported* via *steamer or road*:—

	Maunds.	Tons.
1912—1913	144,039	5,291
1913—1914	98,606	3,625
1914—1915	84,860	3,117
1915—1916	240,143	8,821

Co-operative Fishery Societies.—During the year, the two Superintendents of Fisheries and the Zoological Assistant underwent a course of training under the Registrar of Co-operative Societies. Mr. Das and Ghosh were placed under the Registrar of Bengal, and Mr. Mohsin under the Registrar in Bihar and Orissa. The object was to train these officers for undertaking co-operative fishery work.

Up to the present, the following Co-operative Fishery Societies have been established in Bengal, largely owing to the energy of Rai Jamini Mohan Mitra Bahadur, the Registrar of Co-operative Societies, Bengal :—

Serial No.	Districts.	Name of Society.	Date of Registration.
1	2	3	4
1	Dacca	Ashrafnagar Hindu Bank ...	9-4-14
2	Khulna	Raruli Dhibar Samity ...	13-5-14
3	Midnapur	Bishnupur Dhibar Jautha Bank...	5-1-15
4	Howrah	Chakkashi Ramkrishna Co-operative Bank.	15-2-16
5	Murshidabad ...	Gajipur Halder Rinodan Samity...	28-2-16
6	Pabna	Nemai Charan Halder Rinodan Samity,	5-5-15
7	Tipperah	Gokarna Fishery Jautha Bank ...	10-6-16

It will thus be seen that three new Societies have been inaugurated during the year. Unfortunately no Fishery Societies have yet been formed in Bihar and Orissa. The objects of these Fishery Societies were enumerated in my last report and need not be reiterated here.

Government have now arranged that this Department shall receive six months' notice before the expiry of the lease of all Government fisheries. This is helping us materially at the present time. It gives us the opportunity of preparing the fishermen for undertaking their own improvement. In this way the Department also gets in touch with the fishermen who thus understand our aims and are helping us accordingly. Two or three new and important Societies are about to be formed. Arrangements are being made with the Chairman of the Calcutta Municipality for reserving certain stalls in the market where the catches of these Co-operative Societies can be disposed of without the intervention of middlemen.

General.—During the year, at the request of the Dacca Pearl-Button merchants, steps have been taken by this Department to find markets for their produce. It is to be regretted that the absence of raw material prevents these merchants extending materially the industry at present.

Local buttons are deficient in polish. With a view to remedying this defect enquiries were made in America and Japan as to methods of polishing adopted in these countries. It was found that buttons made from local shells cannot be polished as satisfactorily as buttons made from shel l in Japan and America, the reason being that unfortunately the local shells have an unsatisfactory colour throughout their thickness.

The Government of Assam have requested the Government of Bengal to include the Assam fisheries in the investigations of this Department. The Government of Assam offered to appoint and maintain an official on a commencing salary of about Rs. 75 per mensem, whose business it would be to learn the work and to confine his attention to the Assam fisheries. In view of the extensive area over which the Department at present works, I could not view the proposal favourably. Government concurred with this view and replied to the Assam Government to the same effect. Eventually, however, it was decided to receive and train a Deputy from Assam. Up to the present the Deputy has not commenced work.

The following order relating to the Bengal Fisheries has been transmitted to the Commissioners of the Burdwan, Presidency, Dacca, Rajshahi and Chittagong Divisions:—

"Six months before a Government fishery is due for re-settlement the Collector should enquire from the Deputy Director whether he is prepared to manage the fishery departmentally, or to constitute a Co-operative Society of fishermen with a view to settlement being made with the Society: he should also enquire from the Deputy Director what restrictions he proposes both as to close times and as to methods of fishing. If departmental management is not found desirable, preference in settlement should be given to a Co-operative Society of fishermen, and in the absence of such a Society leases should be given to one or more selected fishermen. If, for any reason, this is not possible the lease should be given to one or more carefully selected persons who are not fishermen. The practice of settling Government fisheries by open and unrestricted auction should be discontinued. In every case conditions as to close times and methods of fishing should be embodied in the lease in consultation with the Deputy Director of Fisheries. Great care should also be taken in drawing up the remaining conditions of the lease which the circumstances of the individual fishery may require".

As a result of this order, the Fishery Department will fortunately be able to extend its operations and the opportunity will thus occur of effecting such improvements as are indicated in individual cases. The Government of Bihar and Orissa are at present considering a similar proposal.

During the year, a fish pass has been erected over the Mahanadi at Cuttack. We can now reasonably expect a slow but sure improvement of the fisheries in that river.

Working in conjunction with the Collector of Bankura, arrangements have been made for distributing fry, free, amongst the famine-stricken fishermen of that district. Fifty-eight fishermen applied for assistance, and in all, we expect to distribute about two lakhs of fry for cultivation in tanks. This measure of relief appears to have given satisfaction to the parties concerned.

B. & O. G. P. (Agri). No. 60—520—4-1-1917—H. F. C.—S. A.

REPORT

ON THE

AGRICULTURAL ACTIVITIES OF GOVERNMENT

IN

BIHAR AND ORISSA

FOR

THE YEAR 1916-17

Ending the 30th June 1917.

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